CONFERENCE PROGRAM AND ABSTRACTS

Content

EMAC 2011

European Meeting on Ancient Ceramics

September 29th-October 1st 2011
Vienna, Austria

EMAC 2011
11th European Meeting on Ancient Ceramics
Vienna, Austria

September 29th-October 1st 2011

at the

Natural History Museum, Vienna

CONFERENCE PROGRAM AND ABSTRACTS

Content

The EMAC 2011 is organised by the University of Vienna (VIAS, Department of Lithospheric Research) and the Natural History Museum, Vienna:

Local organising committee

Irmgard Hein	**University of Vienna, Austria**
Anton Kern	Natural History Museum, Austria
Kerstin Kowarik	**Natural History Museum, Austria**
Theodoros Ntaflos	University of Vienna, Austria
Cornelius Tschegg	**University of Vienna, Austria**

Scientific Committee

Katalin Biro	Hungary
Jaume Buxeda i Garrigós	Spain
Peter Day	United Kingdom
Malgorzata Daszkiewicz	Poland
Corina Ionescu	Romania
Vassilis Kilikoglou	Greece
Ivelin Kuleff	Bulgaria
Marino Maggetti	Switzerland
Hans Mommsen	Germany
Yona Waksman	France

Published 2011 by the University of Vienna (Vienna, Austria) with financial support of VIAS, University of Vienna.

Cover design and production: Norbert Irnberger, Cornelius Tschegg
Editing: Irmgard Hein, Angelika Kern, Kerstin Kowarik, Cornelius Tschegg

Preface

Pottery is a basic artefact of human development; it is an important source for all archaeological studies and for studies on art and technology of material culture. The main focus of EMAC is directed towards interdisciplinary studies and the archaeological interpretation of ancient ceramics. The scientific progress of the last decades offers new approaches to analyse materials in various ways, and the application of such methods shows new fascinating insights in the composition and technology of the materials.

It is the intention of EMAC to bring together established scholars, young researchers and students from a wide range of academic backgrounds, all working with archaeological finds of ceramics. The idea is not only to reach archaeologists and art historians, but chemists, geologists, petrologists, material scientists, and colleagues from other related disciplines, which are interested in analysing the ancient finds.

The call for the conference was open for a wide range of topics including methodological development, technology, geoscientific approaches for provenance studies, but also decoration technology and conservation and other fields.

A large variety of analytical methods and new results will be presented in the talks and posters during the conference. 130 abstracts have been submitted and we are grateful in the first place to the members of the scientific committee, for their wise comments on the contents, and their often meticulous work, in order to create a broad scientific spectrum for the oral as well as for the poster sessions. For the three days of conference, the requests for oral papers was much larger than the finally accommodated presentations, and we wish explicitly to state, that the often hard decisions between oral and poster were made not to create a different scientific level, but to keep a broad diversity of topics in all sessions. The organisers however are responsible for the final placement and the final decision on the papers, and for the layout of the final program.

Some words have to be spent about the organization of the conference, and about the opportunities, which were opened for us to let the meeting take place in Vienna.

We are most grateful to the Museum of Natural History for the opportunity to house the meeting in this traditional location at the Wiener Ringstrasse, in particular we thank the Director of the Museum C. Köberl. In this house we thank the director of the Department of Prehistory in this Museum A. Kern for the generous support and providing us with equipment and supplies for the breaks.

Within the University of Vienna we thank Vice-Rector H. Engl, for his encouragement for interdisciplinary research, for admission and for the financial support for the organisation of the meeting via the scientific research platform VIAS. Within this research unit VIAS, we thank the Director of the scientific platform, M. Bietak for financial commitment, as well as G. Sentall for handling the details.

The conference office of the University of Vienna was consigned with the computerized administration of the participants, and we want to thank the members of this team, in particular G. Schneider, for the careful handling of sometimes difficult matters.

Finally we want to thank the contributors for sending the abstracts and to present the newest results about studies on ancient ceramics.

We wish all the participants an interesting and successful meeting at EMAC 2011 in Vienna!

Irmgard Hein **Kerstin Kowarik** **Cornelius Tschegg**

Vienna, September 9th 2011

Technical abbreviations in the abstracts

DTA	differential thermal analysis
EDXRF	energy dispersive x-ray fluorescence
EPMA	electron probe micro-analyzer
FTIR	Fourier transform infrared
INAA	instrumental neutron activation analysis
LA-ICP-MS	laser ablation inductively coupled mass spectrometry
MC-ICP-MS	multi collector-inductively coupled plasma mass spectrometry
NAA	neutron activation analysis
OM	optical microscopy
OSL	optically stimulated luminescence
PGAA	prompt-gamma activation analysis
PIGE	particle-induced gamma-ray emission analysis
PIXE	particle induced x-ray emission
PXRF	portable XRF
XRD	x-ray diffraction
XRF	x-ray fluorescence
XRPD	x-ray powder diffraction
REE	rare earth elements
SEM	scanning electron microscope
SEM-EDS	scanning electron microscopy used with energy dispersive spectroscopy
SEM-EDX	scanning electron microscopy used with energy dispersive spectroscopy
TL	thermoluminescence
WD-XRF	wavelength dispersive x-ray fluorescence

Conference overview

Wednesday, September 28th

18:00-20:00 Get together in the Museum of Natural History

Thursday, September 29th

8:30- 9:30 Registration
9:15- 9:45 Opening of the Conference
9:45-10:45 Session 1: Methodological studies and pottery dating.
Chair: *V. Kilikoglu, H. Mommsen*
10:45-11:15 Coffee break
11:15-12:00 Session 1: Methodological studies and pottery dating.
Chair: *V. Kilikoglu, H. Mommsen*
12:00-13:00 Lunch break
13:00-14:30 Session 2: Technological pottery studies and vessel functions.
Chair: *M. Daszkiewicz, J. Buxeda i Garrigós*
14:30-15:00 Coffee break
15:00-16:30 Session 2: Technological pottery studies and vessel functions.
Chair: *M. Daszkiewicz, J. Buxeda i Garrigós*
16:30-18:00 Postersession I Topics: Methodological studies and pottery dating; Technological pottery studies and vessel functions; Decoration technologies, Slips and Glazes, Conservation and ceramics as Building materials;
18:00-19:30 Optional: Vienna City Town Walk

Friday, September 30th

8:30-10:00 Session 3: Decoration technologies, Slips and Glazes, Conservation and ceramics as Building materials.
Chair: *Y. Waksman, I. Kuleff*
10:00-11:30 Coffee Break
11:30-12:00 Session 3: Decoration technologies, Slips and Glazes, Conservation and ceramics as Building materials.
Chair: *Y. Waksman, I. Kuleff*
12:00-13:00 Lunch break
13:00-14:30 Postersession II: Topics: Geoscientific approaches; Provenance of raw materials, Production, Distribution, Trade & originals and imitation;
14:30-21:30 Optional: Excursion to the Roman Site of Carnuntum and Conference dinner at location nearby (outside of town)

Saturday, October 1st

9:00-10:45 Session 4: Geoscientific approaches and provenance of raw materials. Chair: *C. Ionescu, M. Maggetti*
10:45-11:15 Coffee Break
11:15-11:45 Session 4: Geoscientific approaches and provenance of raw materials. Chair: *C. Ionescu, M. Maggetti*
11:45-12:30 Session 5: Production, Distribution, Trade & Originals and imitation.
Chair: *K. Biro, P. Day*
12:30-14:00 Lunch break
14:00-15:30 Session 5: Production, Distribution, Trade & Originals and imitation.
Chair: *K. Biro, P. Day*
15:30-16:00 Coffee break
16:00-16:45 Session 5: Production, Distribution, Trade & Originals and Imitation:
Chair: *K. Biro, P. Day*
17:00-18:00 Closing Session

Conference program

Thursday, 29th of September

9:15- 9:45	Opening of the Conference by the Director of the Museum of Natural History C. Köberl, the director of the Dept. of Prehistory, A. Kern and a representative of the Unviersity of Vienna
9:45-12:00	Session 1: Methodological Studies and Pottery Dating. Chair: *V. Kilikoglou, H. Mommsen*
9:45-10:00	Post-depositional alteration effects on the structural integrity of archaeological ceramics *Müller, N.S., Gomez Ferrer,S., Buxeda i Garrigós, J., Kilikoglou, V.*
10:00-10:15	One step beyond - 'Mycenaean' pottery production in Central Greece *Hein, A., Kilikoglou V., Mommsen, H.*
10:15-10:30	MGR-analysis, WD-XRF and thin sections - integrated approach vs. chemical fingerprinting *Daszkiewicz, M., Schneider, G.*
10:30-10:45	Recognition of ceramic types using digital image processing by means of morphological filters *López García, P., Hein, I., Argote, D., Tschegg, C.*
10:45-11:15	COFFEE BREAK
11:15-11:30	Coarsewares - from the bottom of the food-chain in Mediterranean pottery studies *Strack, S.*
11:30-11:45	First analysis of Syrian lustre pottery (11th-14th centuries AD) *Pradell, T., Tite, M.S., Molera, J.*
11:45-12:00	A TL analysis of ceramics from cairns in Jordan: using thermoluminescence to integrate off-site features into regional chronologies *Fraser, J., Price, D.*
12:00-13:00	LUNCH BREAK
13:00-14:30	Session 2: Technological Studies and Vessel Functions. Chair: *J. Buxeda i Garrigós, M. Daszkiewiecz*
13:00-13:15	Four Archaeological Sites, but how many potters? The petrographic analysis of Early Neolithic Pottery from Thessaly, Greece *Dimoula, A.*
13:15-13:30	Archaeometrical study on Late Bronze Age ceramics from Tatarli Höyük *Kilinc, Mirdali N., Girginer, S. Girginer, Ö, Temucin, F.*
13:30-13:45	Characterisation of Celtiberian Pottery from the Central Iberian Range (Aragon, Spain): Materials, decoration and manufacture *Pérez-Arantegui, J., Igea, J., Lapuente, P., Saiz, M.E.*
13:45-14:00	Early Roman pottery production in the civitas Tungrorum, Belgium: towards an integrated approach *Borgers, B., De Bie, M., Degryse, P., Quinn, P.*
14:00-14:15	Technological study of Hellenistic ceramic beehives found at Tragaia island (Agathonisi), Greece *Karatasios, I., Triantafyllides, P., Hein, A., Kilikoglou, V.*
14:15-14:30	Investigating Early Pottery Uses in Northeastern North America *Taché, K.*
14:30-15:00	COFFEE BREAK
15:00-15:15	Paul-Louis Cyfflé's (1724-1804) search for porcelain *Maggetti, M.*
15:15-15:30	A study on the White Porcelains from Dehua Kiln Site of Ancient China *Li, W., Luo, H., Li, J., Lu, X.*
15:30-15:45	The rise and evolution of White Porcelain in Ancient China *Luo, H., Li, W., Lu, X., Sun, X., Zhao, Z.*
15:45-16:00	Old City, New City: majolica production strategies in colonial Panamá *Iñañez, J., Martín, J.*

16:00-16:15 Characterization of an unknown production of faience: the manufacture Babut in Bergerac (France, 18th century)
Emery, L.

16:15-16:30 Early Cacao Use among the Olmec
Powis, T., Cyphers, A., Gaikwad, N.W., Grivetti, L., Cheong, K.

16:30-18:00 Postersession I: Topics: Methodological studies and pottery dating; Technological pottery studies and vessel functions; Decoration technologies, Slips and Glazes, Conservation and ceramics as Building materials;

18:00-19:30 OPTIONAL: Vienna City Walk

Friday, 30th of September

8.30 - 12.00 Session 3: Decoration technologies, Slips and Glazes, Conservation and ceramics as Building materials. Chair: *Y. Waksman, I. Kuleff*

8:30- 8:45 On the tracing of curvilinear patterns on prehistoric vases in South Eastern Europe
Gheorghiu, D.

8:45- 9:00 Brown decorations in 10th to 18th centuries Spanish tin glazed ceramics
Molera, J., Coll, J., Labrador, A., Pradell, T.

9:00- 9:15 Archaeometric characterization of 17th century tin-glazed Anabaptist (Haban) faience from NE-Hungary
Bajnóczi, B., Tóth, M., Nagy, G., May, Z.

9:15- 9:30 Capodimonte porcelain: Glaze composition and its technological implications
Bruno, F., Gualteri, S.

9:30- 9:45 Aggregate, binder and wine: Archaeometric study of Punic mortars from Sardinia
Alonso Lopez, E., van Dommelen, P., Whitbread, I.

9:45-10:00 Technical ceramics for glass annealing in the forest glassworks of Derrière Sairoche (Court, Swiss Jura): Provenance determination and functional analysis
Eramo, G., Zanella, E., Frey, J.

10:00-10:30 COFFEE BREAK

10:30-10:45 Cucuteni Neolithic Ceramic: Research and restoration - conservation
Geba, M., Huet, N., Turcanu, S., Vlad, A.-M., Lacatusu, C., Husleag, A., Teodor, L., Dascalache, M.

10:45-11:00 Alteration of lead-glazed ware and amphorae from shipwrecks in the Black Sea (Ukraine)
Maritan, L., Waksman, Y. , Secco, M., Lampronti, G.I., Mazzoli, C.

11:00-11:15 Characterization and conservation of 17th century Portuguese glazed ceramic tiles: A case study
Almeida, S., Vilarigues, M. Lima, A., Duarte, A.

11:15-11:30 The project of conservation and restoration due to fading of glaze in the seven-colored tiles of Imam Ali's Holy shrine, Najaf, Iraq (based on laser technique)
Soltanzadeh, S., Vatandoust, A.R.

11:30-11:45 Ascertaining the degradation state of ceramic tiles: a preliminary non-destructive step in view of conservation treatments using gamma radiation
Silva, T., Figueiredo, M.-O., Prudêncio, M.-I.

11:45-12:00 The performance of different adhesives for archaeological ceramics under mechanical stress
Alexiou, K., Karatasios, I., Müller, N., Kilikoglou, V.

12:00-13:00 LUNCH BREAK

13:00-14:30 Postersession II: Topics: Geoscientific approaches, Provenance of raw materials; Production, Distribution, Trade & originals and imitation;

14:30-21:30 OPTIONAL: Excursion to the Roman site of Carnuntum and conference dinner at a location nearby

Saturday, 1st of October

9.00-11.30 Session 4: Geoscientific approaches for vessel analyses, Provenance of raw materials. Chair: *C. Ionescu, M. Maggetti*

9:00- 9:15 Technology, use and volcanological relevance of the Early Bronze Age pottery from Afragola Village (Naples)
Eramo, G., Gargallo, A., Zanella, E, Nodari, L., Russo, U., Bishop, J.

9:15- 9:30 Siliceous slag in the Lapus Bronze Age funerary site (NW Romania): Overburned ceramic vessels?
Ionescu, C., Hoeck., V., Metzner-Nebelsick, C., Kacsó, C.

9:30- 9:45 Slag-tempered ceramics from the Lapus Bronze Age funerary site (NW Romania)
Hoeck, V., Ionescu, C. , Metzner-Nebelsick, C., Kacsó, C.

9:45-10:00 Ceramic Distribution, Migration and Interaction among huntergatherers in Late Prehistoric (1300-200 YBP) San Diego County, California
Quinn, P., Burton, M., Byrne-Bowles, R.

10:00-10:15 Highland fine pottery of the Middle Neolithic Bükk culture (NE-Hungary): To fingerprint or not to fingerprint?
Szilagyi, V., Csengeri, P., Mihály, J., Leno, V., Szakmány, G., Schöckle, D., Taubald, H., Biró, K., Tóth, M., Zöldföldi, J.

10:15-10:30 Holocene pottery characterisation from the Takarkori Rockshelter (Libyan Sahara, 9000-4000 BP)
Muntoni, I.M., Eramo, G., Zerboni, A., Aprile, A., Laviano, R., Cavorsi, L., di Lernia, S.

10:30-11:00 COFFEE BREAK

11:00-11:15 Early-medieval pottery from Nikitsch (Burgenland) - An archaeometric approach
Kern, A., Tschegg, C., Gier, S., Ntaflos, T.

11:15-11:30 Compositional analysis of Iron Age ceramics from Tell el-Farah South, Israel: An investigation of provenance and trade
Peloschek, L.

11:30-11:45 Cathodoluminescence (CL) of quartz as a method for archaeological ceramic provenance
Hunt, A.

11:45-16:45 Session 5: Production distribution Trade and Originals & Imitation. Chair: *P. Day, K. Biro*

11:45-12:00 Retrieving the pieces of the past: Magoula Visviki and its pottery assemblage
Pentedeka, A., Alram, E., Dürauer, C.

12:00-12:15 Fineware and beyond: Production and exchange of pottery from the Mycenaean port of Kanakia, Salamis
Day, P.M., Müller, N., Gilstrap, W., Kilikoglou, V., Papadimitriou, A., Marabea, C., Yannos, G.

12:15-12:30 Ceramic production and distribution in North-East of Italy: a possible trade network between the Friuli Venezia Giulia and the Veneto regions during the final Bronze Age and the beginning of the Iron Age
Tenconi, M., Maritan, L., Leonardi, G., Prosdocimi, B.

12:30-14:00 LUNCH BREAK

14:00-14:15 Defining Corinthian cooking fabric from Late Roman Panayia Field, Corinth
Graybehl, H., Hammond, M., Day, P.

14:15-14:30 The combined use of petrography and petrology to investiagte the Bronze Age inter- and extra-insular pottery network exchange in the Aeolian Archipelago
Fragnoli, P., Levi, S. T., Brunelli, D.

14:30-14:45 Black gloss and terra sigillata from the Roman Town of Cosa (1st BC - 1st AD). An approach to its provenance and technology
Madrid i Fernandez, M.,Buxeda i Garrigós, J., Roca Roumens, M.

14:45-15:00	Cooking pot technologies and cultural change in South East Spain in the 6th-11th centuries *Carvajal, J.C., Day, P.M.*
15:00-15:15	Istanbul Ceramic Workshops Project. First laboratory study of a Constantinopolitan production of Byzantine ceramics *Waksman, Y.*
15:15-15:45	COFFEE BREAK
15:45-16:00	Brides neighbours and pottries: Ceramic distribution networks in the Upper East of Ghana *Calvo, M., García Rosselló, J., Albero, D., Javaloyas, D.*
16:00-16:15	Ceramic industries of Mesoamerica's coastal wetlands *Neff, H., Murata, S.*
16:15-16:30	Pottery sourcing via petrography, portable XRF, and LA-ICP-MS: A study of production and circulation of the first pottery in Panama produced by farmers (ca. 4500-3200 B.P.) *Iizuka, F.,Neff, H., Cooke, R.*
17:00-18:00	CLOSING SESSION

Post-depositional alteration effects on the structural integrity of archaeological ceramics

Noémi Suzanne Müller[1)], Samantha Gomez Ferrer[1)], Jaume Buxeda i Garrigós[1)], Vassilis Kilikoglou[2)]

[1)] University of Barcelona, Barcelona, Spain;
[2)] N.C.S.R. "Demokritos", Athens, Greece;

To date, the post-depositional alteration of archaeological ceramics has been studied mainly in the context of provenance investigations since it may effect their elemental composition. Little attention has been paid to the microstructural changes that alteration processes may induce in the ceramic material.

In the framework of a large-scale study of pottery related to the Spanish Atlantic colonial expansion, we studied 16th century transport vessels both from production centres on the Iberian Peninsula and retrieved from consumption sites in the Americas. Samples were analysed by a combination of physico-chemical methods to address aspects of provenance and technology, including performance characteristics. We found significant lower strength levels for transport jars retrieved in the Americas than for vessels found at their production sites on the Iberian Peninsula. Since differences in strength coincided with the presence or not of metastable gehlenite, we suspected post-depositional alteration phenomena, caused by exposure to continuous high levels of humidity, to be responsible for strength degradation of European ceramics retrieved from sites in (sub)tropical climates of South- and Mesoamerica.

In order to establish the influence of humid burial conditions on the mechanical strength of calcareous pottery, we conducted a series of controlled laboratory experiments, assessing the transverse fracture strength of experimental briquettes both on untreated and on artificially aged specimens. Mineralogical composition was monitored by XRD while microstructure was examined by SEM. The results which highlight the influence of burial on mechanical properties are presented and implications discussed.

One step beyond - 'Mycenaean' pottery production in Central Greece

Anno Hein[1)], Vassilis Kilikoglou[1)], Hans Mommsen[2)]

[1)] N.C.S.R. "Demokritos", Athens, Greece;
[2)] University of Bonn, Bonn, Germany;

During the Late Bronze Age (LBA), pottery production in the Greek mainland reached very high standards, in terms of material quality and artistic level. Particularly the region around Mycenae (Argolid) has been proved to be the most important production area for this kind of pottery. Pottery from the Argolid has been apparently exported to regions as far as Egypt, Asia Minor or the Balkans. These trade relations have been verified in the past by the means of chemical provenance studies using neutron activation analysis. The initial area of research was focused in the Argolid itself, but soon after it was enlarged step by step by including other important production regions in the Peloponnese, Attica and Boeotia. The general picture achieved in these studies shows commonly a large part of locally produced Mycenaean pottery together with imports from already known production places such as the Argolid, Aegina, Boetia and “unknown” production places which still have to be identified.

During the recent years, in a continuation of our LBA pottery research, regions towards the north and the west of Boeotia were studied, in an attempt to understand relationships of the large centres with the periphery of the Mycenaean world. The areas concerned in the present study include sites in Phocis, Phtiotis and East Locris with the intention to provide an overview, in terms of elemental analysis, of the studied ceramic assemblages. The assemblages will be evaluated and compared in view of local pottery production and imported pottery in order to explore trade relations and craft traditions. Therefore, chemical compositions and variations will be compared with already existing data on the ceraDAT database. This study at the same time is a quality control test for the suitability of the database to be used for evaluating datasets from different laboratories based on assemblages studied with different sampling strategies and analytical routines.

MGR-analysis, WD-XRF and thin sections - integrated approach vs. chemical fingerprinting

Malgorzata Daszkiewicz[1)], Gerwulf Schneider[2)]

[1)] ARCHEA, Warszawa, Poland;
[2)] Freie Universität Berlin, Berlin, Germany;

Raw material classification for provenancing pottery in the past was done using either thin section studies or chemical analysis. The combination of petrographic and chemical methods was applied only in a few archaeometric laboratories and the necessity of this integrated approach was often questioned especially when neutron activation was used to determine provenances by chemical fingerprints. To characterize the complete material of a ceramic object, however, we need information not only on the bulk chemical composition but on the non-plastic inclusions and the clay matrix as well. Thin sections allow to determine the fabric and to identify the inclusions. The refiring of small fragments at various temperatures above 1000°C enables the grouping of sherds according the composition of their clay matrix. Chemical analysis of powdered samples is done by WD-XRF and is compared to the limited results received from portable ED-XRF on fresh breaks. A down-up-sampling strategy helps to reduce costs. Examples from various studies of the last years will show advantages of the integrated methodology and of the limits of the single method approach.

Recognition of ceramic types using digital image processing by means of morphological filters

Pedro López García[1)], Irmgard Hein[2)], Denisse Argote Espino[3)], Jorge Lira Chávez[4)], Cornelius Tschegg[5)]

[1)] Escuela Nacional de Antropología e Historia, Mexico;
[2)] VIAS and Egyptology, University of Vienna, Austria and University of Uppsala, Sweden;
[3)] Instituto de Geología, UNAM, Mexico;
[4)] Instituto de Geofísica, UNAM, Mexico;
[5)] Department of Lithospheric Research, University of Vienna, Vienna, Austria;

The digital processing of images can be used to make analysis of ceramic pastes in an automated form, contributing with this to the designation of ceramic origins. The method proposed involves several stages of analysis: digitalization of ceramic pastes images, preprocessing of the images, particle segmentation, calculation, quantification and classification of the particles size. This procedure uses interactive algorithms of segmentation of images and grain size analyses derived from the mathematical morphology theory. For each image it is necessary to isolate the matrix of the paste in order to get the quantification of the morphology of particles. Then morphologic operators are applied to quantify the density and type of particles present in an image. Later, the statistical moments of each sample are obtained derived from the phantom pattern of each image which produces a histogram of the distribution of the sizes of the diverse objects that compose an image. The extracted parameters are average, variance, slant and kurtosis of this phantom that allow making a quantitative analysis of the content of the ceramic paste image. These parameters are sorted with a statistical algorithm known as DBSCAN to discriminate between ceramic types.

In order to prove the method, already analyzed samples of ceramics of different origin were processed. The first group was Cypriot "Bichrome Wheel-made ware" from the Late Bronze Age (1550-1450 B.C.) analyzed by microscopy, XRD, XRF, ICP-MS, EPMA. The second demonstration corresponds to Mesoamerican ceramics of the Aztec culture (1300-1521 A.C.) analyzed with Neutron Activation instrumental technique. In both cases the results thrown by our method agree with the analytical analyses performed.

Coarsewares - from the bottom of the food-chain in Mediterranean pottery studies

Sara Strack

University of Leicester, Leicester, United Kingdom

The term 'coarseware' is used to denote both a technological grouping – pots made from coarse fabric, and a functional subset – utilitarian ceramics. This paper examines the application and connotations of this term, as well as recent developments in coarseware studies, and proposes an outlook towards an integrated study of utilitarian ceramics.

Coarsewares represent a major part of archaeological ceramics. Depending on find location and 'school' of the excavators, however, they have been treated in a widely disparate fashion. While ideally, all ceramic finds should be assessed as one coherent assemblage, pottery studies in the Mediterranean (Bronze Age to Roman) have often largely ignored coarse pottery, focusing instead on fine decorated wares which have been deemed aesthetically more appealing, more relevant for questions of chronology and reconstruction of ancient contacts, and indicative of elite habits and tastes.

Interest in non-decorated wares has developed along with other concerns: amphorae have been studied as evidence for ancient trade, and the emergence of household archaeology has ignited research into cooking wares and the furnishings of ancient kitchens more generally. Approaches to coarseware studies incorporating quantitative methods, archaeometry, and functional analysis are now yielding new insights into ceramic production, small-scale and regional exchange networks, and into ancient everyday life, such as foodways and the organization of domestic space.

First analysis of Syrian lustre pottery (11th-14th centuries AD)

Trinitat Pradell[1)], M.S. Tite[2)], Judit Molera[3)], G. Molina[1)]

[1)] Universitat Politècnica de Catalunya, Barcelona, Spain;
[2)] Research Laboratory for Archaeology and the History of Art, Oxford, United Kingdom;
[3)] Universitat de Vic, Vic, Spain;

Lustre is an expensive art form developed with a strong scientific background and product of skilled artisans. Consequently, although it is likely that the movement of artisans within the caliphate spread lustre technology to different regions, it explains why the main expansions of lustre technology occurred after the collapse of dynasties resulting in the migration of artisans to new production centres closer to the political powder. Each lustre production has its own peculiarities not only both in the lustre composition and microstructure but also in the pastes and glazes composition, processing and firing conditions. Moreover, our studies have demonstrated that the production of a successful lustre is strongly linked to the composition of the glaze, and that, in particular the use of a lead bearing glaze strongly increases the possibility of obtaining a successful golden lustre. Basically, copper and silver have a lower diffusivity in lead bearing glazes leading to more concentrated lustre layers and therefore, more likely to show the characteristic golden shine. However, different strategies maybe followed to obtain successful lustres; the precipitation and growth of the metal nanoparticles may be strongly improved by adding reducing agents in the glaze composition such as Sn^{2+}, Fe^{2+}; adding reducing agents in the lustre paint (such as Bi). Syrian lustre is particularly interesting as it shows technological innovations with respect to the earlier Abbasid and Fatimit Egyptian lustre productions; transparent tin-free glazes (often alkaline) were used over very white stonepastes. In particular, the use of alkaline glazes should be accompanied by technological novelties in order to increase the chances to produce a successful lustre. We will show the first analysis (UV-Vis, XRD, TEM and SEM-WDS) obtained on three earliest Syrian lustre productions, namely Fatimid Tell Mini's (11th century AD), post-Fatimid Raqqa (late 12th century AD and first half of the 13th century AD) and Damascus (14th century AD).

A TL analysis of ceramics from cairns in Jordan: Using thermoluminescence to integrate off-site features into regional chronologies

James Fraser[1)], David Price[2)]

[1)] The University of Sydney, Sydney, Australia;
[2)] The University of Wollongong, Wollongong, Australia;

The archaeological landscape of the southern Levant (modern Israel/Palestine and Jordan) is renowned for its thousands of stone-built cairns. However, archaeologists have struggled to date these monuments, and so explain the development of this remarkable megalithic phenomenon. These poorly understood, off-site features rarely yield stratified deposits, charcoal or diagnostic ceramics that enable the use of traditional dating methods familiar to Levantine archaeologists working on settlement sites. Consequently, many scholars claim that cairns cannot be directly dated at all, and fall back on the general inference that cairns were built during the Early Bronze Age (c.3600-2000 BC) because they are often found near Early Bronze Age sites.

This paper presents the results of a recent study that used TL to date seven ceramic sherds excavated from four cairns in the eastern escarpment of the Jordan Valley. Although the general TL outputs were low and the TL data often scattered, the results show that the ceramics from two cairns date to the Early Bronze Age, while the other samples date to the late Byzantine-Early Islamic period; evidently, cairn-use was a more complex and enduring phenomenon that currently understood.

This study demonstrates how TL dating of undecorated body-sherds, often ignored or even discarded by archaeologists, can be used to address long-standing archaeological problems, such as the integration of small, off-site features into broader, regional chronologies.

Pores as a significant diagnostic parameter for macroscopic pottery classification

Marcin Baranowski

Antiquity of Southeastern Europe Research Centre University of Warsaw, Warsaw, Poland

Macroscopic descriptions of pottery fabrics were based on the visual examination of sherds, conducted with the unassisted eye, or using a magnifying glass and a binocular microscope at a maximum magnification of 10x. All macroscopic parameters were described in a standardised fashion. The following diagnostic features were taken into account: colour, firing atmosphere, temper, pores, texture, density, fresh fracture appearance, hardness, durability and later changes. The form, quantity and length of pores were determined. Pore form and quantity were both ascertained based on a visual comparative range scale. Pore length was measured under a binocular microscope at 10x magnification. Pore distribution patterns were also taken into consideration (e.g. elongated pores may be aligned parallel to the edges of a vessel creating a cable pattern, elongated pores may be aligned parallel to the edges of a vessel but in random formation, or else elongated pores may form a net-like pattern). Meticulous macroscopic analysis of ceramic fabrics carried out after laboratory groupings have been established enable a set of few diagnostic parameters to be identified which will make it possible to classify pottery into provenance groups associated with production centres. As could be concluded from this work most important diagnostic parameter is shape of pores.

Archaeometrical interpretation for characterization of ancient ceramic matrices from Persepolis, Iran

Mohammadamin Emami[1)], Reinhard, Trettin[2)]

[1)] Art University Siegen, Isfahan, Iran;
[2)] Institut fuer Bau- und Werkstoffchemie, Siegen, Germany;

Investigated materials sampled from world cultural heritage site of Persepolis (Takht-e Djamshid). Mineralogical investigations for understanding the production process, mainly firing, are among the most important goals of the present investigations.

Chemical composition as well as statistical distribution of elements characterized by XRF Analyses. The crystalline phase composition was determined by QXRD measurements with Rietveld refinement. The results have been matched with microscopically methods as well as DSC and EDX measurements in order to obtain a chemical-petrological conclusion. Cluster analyses would be informative due to classification of the similarities that revealed between different kind of materials which have been used in the ancient word.

The chemical analyses proved that these kinds of materials categorized as high SiO_2 ceramics according to $CaO+MgO - Al_2O_3 - SiO_2$ system. According to the QXRD reaults, technology used for manufacturing these ceramics was based on the local soil. The experiments show the material generation through the topography and grain boundaries. AFM pictures gave sufficient informations on sintering around grains and the spreading of this process from the grain boundary into the matrix of the ceramic. The sintering has occurred under reduction and oxidation procces.

The use of PIXE and LA-ICP-MS applied on some French faiences of the South West of France

Laetitia Emery[1)], Stephan Dubernet[1)], François-Xavier Le Bourdonnec[1)]

[1)] IRAMAT-CRP2A, Pessac, France;

This work falls within the framework of a research programme on the production of some French faience of the south west of France. Two productions have been studied on an archaeometric point of view: the Royal Manufacture of Samadet (Landes) and the manufacture Babut in Bergerac (Dordogne), fabrics established during the 18th century. This research aims at understanding and determining the technological development of these productions in the wake of the Industrial Revolution, and in the same time to contribute to the elaboration of an “identity card” for those faiences.

A non-destructive methodological approach was developed on the study of the tin opacified lead-alkali glaze of those faiences. They were analysed by PIXE at AGLAE facility (Centre de Recherche et de Restauration des Musées de France, Paris) and by LA-ICP-MS (Centre Ernest Babelon, Orléans). The analyses were performed both on polished sections and on the rough samples. The applicability of those methods was checked by comparing the results obtained. The first results showed some common characters (chemical content of some elements) but also some divergent one (chemical contents and elements detected). We will show the potential of those methods for archaeological purposes to study faiences as well as the limits.

XRF analysis of the Buff Wares of Shahr i Sokhta

Hossein Moradi

ICHTO, Borujen, Iran;

Shahr i Sokhta is located in the South Eastern part of Iran and excavations revealed four periods of occupations, from 3200 to 1800 B.C. The amount of sherds in the eastern residential and monumental area is very large. The pottery was made both at Shahr i Sokhta and in artisanal areas around it, as Tepe Dash and Tepe Rudi Biyaban, south-east of Shahr i Sokhta. Pottery was wheel made and in the majority of the cases the color of the paste is buff. Buff ware is indeed the prevalent pottery at Shahr i Sokhta and it ranges from an absolute buff to green. From the statistical point of view gray ware is the second in diffusion and red ware is the third. The 12 samples examined in this analysis were gathered from XFN in the Eastern Residential Area of Shahr-i Sokhta. Since the common color of the pottery at Shahr-i Sokhta is buff and we collected more samples of this class to have significant results.

The aim of the present research, is the chemical and XRF analysis of the pottery of Shahr-i Sokhta in the 3rd millennium B.C. This research pursuits two principal aims:

1-What is the influence of the different chemical elements and of their percentage on the color of this pottery?

2-What is the reasons of the brick color in some of the pottery?

Petrodatabase: An on-line database for thin section ceramic petrography

Patrick Quinn

University College London, Institute of Archaeology, London, United Kingdom;

Petrographic data on ancient ceramics is normally underrepresented in the archaeological literature, with published analyses supported by a limited number of black-and-white micrographs and fabric descriptions rarely included. This situation hinders the comparison of petrographic data between different sites, studies and laboratories.

In response to this problem we have designed and built the first on-line petrographic database for the study of ancient ceramics. This tool provides an efficient means of storing, accessing and disseminating petrographic data, including colour micrographs, petrographic descriptions and associated information about artefacts.

The database is freely available to the archaeological community. Registered users can browse and search petrographic data via a user-friendly web interface, as well as uploading their own projects and images. Central to the system are large, high-resolution polarizing light micrographs of individual thin sections for direct comparison during microscope work.

The transferral of petrographic information into electronic databases will greatly assist the curation of the extensive thin section collections that exist worldwide, ensuring their survival for future research. Given that most ceramic analysts are never very far from a computer, the presentation and manipulation of data and reference material through this medium also has benefits for research productivity.

Four archaeological sites, but how many potters? The petrographic analysis of Early Neolithic pottery from Thessaly, Greece

Anastasia Dimoula

Aristotle University of Thessaloniki, Thessaloniki, Greece;

Argissa, Otzaki, Soufli and Melissochori are four Neolithic sites that bear as common characteristics not only their form as tells, their location in the center of the eastern thessalian plain and the contiguity between them, but mostly the identification in their archaeological deposits of the remains of some of the earliest Neolithic settlements in Greece. Thereupon, the archaeological data of these sites, and particularly pottery, have frequently been used in discussions regarding the beginning of the Neolithic way of life in Thessaly.

The present study seeks, through the integrated scientific analysis of pottery samples deriving from the chronologically earliest contexts of the sites, to elucidate aspects of their manufacturing technology, along with the nature and provenance of their raw materials, in order to further discuss issues concerning the production, circulation and consumption of the pots. Additionally, it attempts to contribute to a better understanding of the initiation of pottery technology in this area, along with the ideas and practices the introduction of a new technology implicated at the very start of the Neolithic.

Archaeometric study on Late Bronze Age ceramics from Tatarli Höyük

Nergis Kilinç Mirdali[1)], Serdar Girginer[1)], Özlem Girginer[1)], Fatma Temuçin[1)]

[1)] Çukurova University, Adana, Turkey;

Tatarli is in the middle of important trade routes, about 10 km west of Osmaniye- Toprakkale and west-northwest and north of Nur Mountains. Tatarlı Höyük is located in the north of the village of Tatarlı, the Ceyhan district of Adana province, about 5 km from Mustafabeyli district. M.V. Seton-Williams has performed surveys on the Tatarlı Höyük in 1951 and has identified the presence of the Neolithic, Chalcolithic (Tell Halaf), Assyrian, Late Bronze Age, Hellenistic and Byzantine periods.

In this study, it was investigated the technological aspects of Late Bronze Age Ceramics from Tatarlı Höyük, Adana, Turkey. Scanning Electron Microscopy (SEM/EDX) and X-Ray Difraction (XRD) analysis were carried out and results were discussed.

Characterisation of Celtiberian pottery from the Central Iberian range (Aragon, Spain): Materials, decoration and manufacture

Josefina Pérez-Arantegui[1)], Jesús Igea[1)], Pilar Lapuente[1)], Maria Esperanza Saiz[2)], Francisco Burillo[3)]

[1)] University of Zaragoza, Zaragoza, Spain;
[2)] Centro de Estudios Celtibéricos de Segeda, Mara, Spain;
[3)] University of Zaragoza, Teruel, Spain;

In the last years an extended program on archaeometric research of the Celtiberian pottery production centres situated along the central Iberian Range (Aragón, Spain) is carried out. The Celtiberian culture was developed in the Iberian Peninsula in the final centuries BC, as integration between Celts and Iberians, and occupied the present north-central Spain. The Celtiberians were the most influential ethnic group in pre-Roman Iberia, and they had a large impact on history recognised by Greek and Roman historians. Twelve pottery workshops, dated from the 3rd to the 1st centuries BC, were studied selecting samples from different types of ceramic vessels. The aim of these investigations was to characterise the ceramic materials and technology used in those workshops, in order to know cultural and commercial influences and to have significant data and reference groups for later researches on ceramic provenance. The samples were analysed by means of optical microscopy (OM), X-ray diffraction (XRD), inductively coupled plasma-atomic emission spectrometry (ICP-AES), and scanning electron microscopy (SEM-EDS). Textural analysis was done by means of an image digitalization system. Through an integrated approach, the results allowed to distinguish different ceramic fabrics and to establish the characteristic clays of every pottery workshop. As well as the ceramic body features, the coloured slips used for the decoration of these objects were studied and compared, especially in the case of fragments from the best known workshops. In addition, we improved our knowledge of the technological processes that were involved in the production of this Celtiberian pottery confirming the use of a standardized process.

Early Roman pottery production in the civitas Tungrorum, Belgium: Towards an integrated approach

Barbara Borgers[1)], Marc De Bei[1)], Patrick Degryse[2)], Patrick Quinn[3)]

[1)] Free University of Brussels, Brussels, Belgium;
[2)] Katholic University of Leuven, Leuven, Belgium;
[3)]University College London, London, United Kingdom;

During 50 BC-AD 476, the area of modern Belgium came under Roman rule a change which has been attributed to the emergence of urban life and craft activity. Archaeological research into the Roman period used to examine the placement of pottery industry in relation to urban planning with the result that kilns located in the northern region were interpreted as individual workshops whilst those in the central region as nucleated industries. More recent studies have stimulated a reinterpretation of the nature of the Early Roman period and its regional character, postulating differing acculturation histories of the population groups. Against this emerging picture of Early Roman history, ceramics have the potential to be used as much more than dating tools.

This research explores the potential of ceramics as a source for social history of the civitas Tungrorum. Using petrography and chemistry aspects of technology and provenance are examined for production debris from 5 sites. Two recipes were identified, which can be linked to pottery form and function. Also, a surprising level of compositional homogeneity has been identified with artifacts from different ends of the region produced with similar raw materials and technology. It emerges that potters produced a remarkably consistent paste regardless of variations in local clays. The results show that the compositional analysis offers a means to explore the technological practices within Early Roman traditions in the civitas Tungrorum.

Technological study of Hellenistic ceramic beehives found at Tragaia island (Agathonisi), Greece

Ioannis Karatasios[1)], Pavlos Triantafyllidis [2)], Anno Hein[1)], Vassilis Kilikoglou[1)]

[1)] Institute of Materials Science, National Centre for Scientific Research "Demokritos", Athens, Greece;
[2)] 22nd Archaeological Ephorate of Dodecanese, Department of Archaeological Sites, Research and Monuments, Rhodes, Greece;

This work reports on the technological study of a unique group of ceramic beehives, discovered at the archaeological site of Kastraki, Agathonisi island in Greece. This is an important Late Hellenistic site, situated just off the Ionian coast, near Miletus. The island has a rich production history as witnessed from the variety of findings, which besides the ceramic beehives include a large number of storage and transport amphorae, boiling pans and agricultural tools.

Beehive ceramic material exhibits a porous, rough structure, incorporating several siliceous inclusions. The clay is characterised as calcareous and contains different phyllosilicate phases (mica, chlorite, montmorillonite) and large amounts of calcareous conglomerates. The identification of random areas exhibiting initial vitrification stage indicates low firing of ceramic beehives, which however is consistent, indicating systematic production of this kind of vessels.

This preliminary study based on petrography, microstructure and chemical composition, of ceramics and local clays aims to provide a first insight on the technology of Aegean beekeeping, honey production and its trade. More importantly, it is expected to contribute towards the understanding of the role of Agathonisi in the production and trade of commodities in the wider area of Eastern Aegean.

Investigating early pottery uses in northeastern North America

Karine Taché

University of York, Montréal, Canada;

Unravelling the motives for the adoption of pottery is one of the greatest challenges faced by archaeologists today. This presentation focuses on early ceramic containers from northeastern North America, one region where pre-agricultural pottery has emerged as a problem with broad social and economic implications. Using a sample of potsherds selected from a diversity of ecological and cultural contexts, this research combines archaeological data, lipid analysis, and plant microfossil characterization to highlight variations in early vessel uses, document the context of pottery adoption, and address questions of shifts in subsistence economies. A pilot study indicates that mixtures of meat and plants were cooked in some of North American earliest pots, and that plant resins were used to seal the interior surfaces of containers. Results also highlight the potential of organic residue analysis to reveal subsistence practices previously unrecognized in the archaeological record, or recognized only during later time periods. Through collaborations with the Early Pottery Research Group, this research will contribute to identifying common motives, as well as regionalisms, in the initial uses of ceramic vessels by pre-agricultural societies.

Paul-Louis Cyfflé's (1724-1804) search for porcelain

Marino Maggetti
Fribourg, Switzerland;

7 figurines from private collections, attributed to Cyfflé's Terre de Lorraine manufacture in Lunéville (1766-1780), were subjected to porosity and SEM analyses. The studied samples pertain to four bodies: (1) A porous (18-20 % water adsorption) body of milled quartz-rich frit + anhydrite (former gypsum) + phyllosilicate + Ca-rich matrix; (2) A soft paste porcelain body with quartz + calcic plagioclase (An88-95) + glassy matrix. A coronitic, amorphous reaction rim is visible around the quartzes. The K-rich and Na-poor composition of the frit is best explained as a mixture of potassium nitrate (KNO_3), alum, calcined gypsum ($CaSO_4.2H_2O$), sand, and moderate amounts of salt (NaCl) and soda (Na_2CO_3); (3) A porous (23 % water adsorption), hybrid porcelain body with finely milled particles of quartz, mullite-bearing hard paste porcelain, Na-Ca-Si glass and metakaolinite; (4) A hard paste porcelain body, with relict quartz, andesine plagioclase (An_{37-45}) and kaolinite in a glassy matrix in the underfired, porous (7 %) sample. Well fired figurines have no open porosity due to the pervasive former melt phase. They are mullite rich, with some relict quartz. These wares may contain small amounts of lead (1.8 wt. % PbO) and SO_3 (0.6 wt.%), suggesting the use of lead frit and gypsum. Summarizing, Cyfflé's trial-and-error experiments made use of a remarkably wide range of paste mixtures, culminating with porcelain bodies in the French (soft paste) or the German (hard paste) tradition.

A study on the White Porcelains from Dehua Kiln Site of Ancient China

Weidong Li[1)], Hongjie Luo[1)], Jianan Li[2)], Xiaoke Lu[1)], Jingkun Guo[1)]
[1)] Shanghai Institute of Ceramics, Shanghai, China;
[2)] The Museum of Fujian Province, Fujian, China;

Dehua county is located in central Fujian Province on the southeast coast of China. Dehua is surrounded by mountain and water, rich in porcelain stones, has a convenient transportation, and has been a famous ceramics making area in south China. Dehua porcelains began to be exported abroad in large quantities in the Song Dynasty (960-1279 A.D.) and Yuan Dynasty (1279-1368 A.D.) to Southeast Asia and the Middle East along the Marine Silk Road. Dehua white porcelain production reached its climax in the Ming Dynasty (1368-1644 A.D.), when a large varieties of Dehua white wares were exported to Europe, called blanc de chine by French. Blanc de chine is the masterpiece of Dehua white ware with an ivory white tone, a translucent body and superb shaping and sculpture workmanship.

The production of Dehua porcelain always catered to the demand of overseas market, accordingly the development and flourish of Dehua porcelain has always been closely related to the export trade.

In this study, white porcelain samples excavated from Wanpinglun, Qudougong, Zulonggong, Jiabeishan and Xingjiao kiln sites were analyzed to investigate chemical compositions, microstructures, firing techniques and physical properties of the white porcelains of the Song, Yuan, Ming, Qing Dynasties, trying to reveal the development and evolution regularity of Dehua white porcelains.

The rise and evolution of White Porcelain in ancient China

Hongjie Luo[1)], Weidong Li[1)], Xiaoke Lu[1)], Xinmin Sun[2)], Zhiwen Zhao[2)]

[1)] Shanghai Institute of Ceramics, Shanghai, China;
[2)] Henan Provincial Institute of Cultural Relics and Archaeology, Zhengzhou, China;

People generally thought the earliest white porcelain in ancient China were the wares unearthed from Fancui tomb of Northern Qi dynasty (550-577 A.D.), but the archaeological excavation conducted upon the Baihe kiln site in Gongyi county of Henan province denied the above idea. Many green porcelain shards and a few white porcelain shards of Northern Wei dynasty (386 -534 A.D.) were discovered in the fire box of No.2 kiln, which brought forward the invention time of white porcelain about one hundred years earlier than previously expected.

In this study, the rise and evolution of white porcelain in ancient China was taken as the main research subject. The unearthed porcelain shards of Northern Wei dynasty and Tang dynasty from Baihe kiln site were selected as research objects. Chemical composition, firing temperature, microstructure, physical properties and chromaticity were studied using scientific means. The statistical analysis method was applied to analyze the experimental data to investigate the regularity of the origin and development of Chinese white porcelain. The results showed that white porcelain was derived from green porcelain on the basis of deliberate selection and disposal of raw materials, modification of body and glaze formulae, improvement of firing technologies, and unremitting practices. In the late Tang dynasty, the blue and white porcelain came into being based on the mature technology of white porcelain production.

Old City, New City: Majolica production strategies in colonial Panamá

Javier G. Iñañez, Juan Martín[1)]

[1)] Universitat de Barcelona, Barcelona, Spain;
[1)] Universidad del Norte, Barranquilla, Colombia;

Panamá Viejo was founded in 1519 by the Spanish expeditionary Pedrarias Dávila, becoming an important base for the trade with Spain. In 1671, pirates attacked and sacked the city, resulting in a fire that destroyed it entirely. Thus, a new settlement was built a few miles west, which would become the origin of the modern Panama City. Historically and archaeologically, there is evidence for the majolica production in Panama Viejo, although little is known from the newer settlement of Casco Antiguo. Furthermore, so far the scarce archaeometrical studies conducted on majolica found in Panama are limited mainly to establish the provenance reference group using sherds found in Panama Viejo. Unfortunately, there are no studies that consider the Casco Antiguo majolica or the technological features of this ware.

In this study, archaeometrical characterization of Panama majolica pottery unearthed in recent archaeological excavations at Panama Viejo and Casco Antiguo is carried out by means of Neutron Activation Analysis (NAA), XRD and SEM. The archaeometrical study of these wares will shed light into the understanding of the technological influence on Panama majolica by European and local potting traditions within the cultural frame of societies in contact in a colonial context. Additionally, the supply of raw materials for the potting industry in colonial Panama is assessed diachronically considering the important historical disrupting episode that eventually ended in the relocation of the city. Larger archaeological and historical implications of this important ceramic in the Spanish colonial market within the region are also assessed.

Characterization of an unknown production of faience: the manufacture Babut in Bergerac (France, 18th century)

Laetitia Emery[1)], Françoise Bechtel[1)]

[1)] IRAMAT CRP2A, Pessac, France;

Several hundreds of faience fragments were discovered during archeological excavations on the ancient site of the manufacture of faience Babut in Bergerac, which made it possible to investigate it more satisfactorily. During the second part of the 18th century, three manufactures of faience were active in this city of the South West of France. Jean Babut's was the first of them, established circa 1745, and the production went on until the death of the owner in 1789. From a historical point of view, the factory is rather well documented, but the production is not really known: only three signed pieces can be attributed to Babut. Laetitia Emery's PHD thesis includes an archaeometrical approach of the excavated production in collaboration with the Musée du tabac in Bergerac, in order to understand better the know-how of the manufacture and to reattribute faiences of this region to this workshop. The study reported here focuses on a better knowledge of this production.

About a hundred samples were studied and analyzed, including faiences, decorated or not, kiln furniture and firing wastes. The body was analysed by X-ray fluorescence and X-ray diffraction, which revealed different paste compositions and the use of a calcareous clay and a non-calcareous one. Bulk chemical compositions of the tin opacified lead-alkali glaze placed over the biscuit were obtained by SEM-EDS and PIXE, allowing us to gain a clearer understanding of the glaze mixture. The decorations were also studied from a scientific and iconographic point of view, to test the nature and the use of the raw materials mentioned in the archives of the manufacture. Finally, a statistical approach allowed us to exclude some samples, which can be considered as archaeological pollution.

Early cacao use among the Olmec

Terry Powis[1)], Ann Cyphers[2)], Nilesh W. Gaikward[3)], Louis Grivetti[3)], Kong Cheong[4)]

[1)] Kennesaw State University, Kennesaw, USA;
[2)] Instituto de Investigaciones Antropológicas, Mexico City, Mexico;
[3)] Departments of Nutrition and Environmental Toxicology, Davis, USA;
[4)] Department of Anthropology, Peterborough, Ontario, Canada;

Mesoamerican peoples had a long history of cacao use spanning more than 34 centuries, as confirmed by previous identification of cacao residues on archaeological pottery from Paso de la Amada on the Pacific Coast and the Olmec site of El Manatí on the Gulf Coast, both located in Mexico. Until now, comparable evidence from San Lorenzo, the premier Olmec capital, was lacking. The present study of theobromine residues confirms the continuous presence and use of cacao products at San Lorenzo between 1800 and 1000 BCE and documents assorted vessels forms used in its preparation and consumption. One elite context reveals cacao use as part of a mortuary ritual for sacrificial victims, an event that occurred during the height of San Lorenzo's power.

Crafting continuity and change: The Early Helladic ceramics of Tsoungiza, Nemea

Clare Burke[1)], Peter Day[1)], Daniel Pullen[2)]

[1)] University of Sheffield, Sheffield, United Kingdom;
[2)] The Florida State University, Tallahassee, FL, USA;

Immediately preceding the foundation of the Palaces of Bronze Age Greece, the third Millenium BC has received considerable attention. A key aspect of this research has been the intense discussion about the nature of and changes in ceramic technology across the Aegean, relating trends to wider discussions of societal organisation and development.

Forming part of a broader programme of analysis of Early Bronze Age ceramics from Korinthia and the Argolid, this paper examines results of macroscopic, petrographic and SEM analysis of 154 samples from the settlement site of Tsoungiza, Nemea, excavated by the Nemea Valley Archaeological Project between 1984 and 1986.

This analysis has enabled the reconstruction of technological choices and practices, revealing important patterns of exchange and technological change. Prominent among these has been the identification of imports from the island of Aegina in Early Helladic (EH) I, encompassed within a wider trend for significant variation in paste recipes for this period. It has also been possible to detail the increased standardisation of paste recipes and sophistication of firing techniques from EHI-III. Accompanying these changes is evidence for the continuation of particular recipes traditions/workshops throughout the EH period.

These results indicate the high degree of skilled and knowledgeable practice being undertaken during this period and provide a good insight into the level of interaction between sites and potting communities.

Manganese black in Medieval Azulejos from Portugal

Susana Coentro[1)], R. Silva[2)], R. Trindade[3)],A. Lima[4)]

[1)] Universidade Nova de Lisboa, Caparica, Portugal;
[2)] Instituto Tecnológico e Nuclear, Sacavém, Portugal;
[3)]Instituto de História da Arte, Lisboa, Portugal;
[4)]Departamento de Conservação e Restauro, Caparica, Portugal;

Historic glazed ceramic tiles (“azulejos”) have been part of Portuguese artistic culture for more than five centuries. They were introduced in Portugal through Islamic influence. Between the 15th and 16th centuries, several techniques were used, such as Islamic tile-mosaic (“alicatado”), “cuerda-seca”, “aresta” and reliefs. The colours used for decorating the tiles were achieved by using metallic oxides of copper (green), iron (orange), cobalt (blue), tin (white) and manganese (purple and black). Our study focus on the hues between purple and black obtained with manganese oxide. This compound was used as a colorant in lead-rich glazes and it was also used in the contours of “cuerda-seca” tiles to separate the different colours. A set of tiles from an important Portuguese collection was studied: Santa Clara-a-Velha’s Monastery, in Coimbra. The chemical composition of the manganese colour was studied by non-destructive techniques such as μ-EDXRF (energy-dispersive X-ray fluorescence), μ-Raman microscopy and μ-PIXE (particle-induced X-ray emission). Observations by optical microscopy were also performed. Our aim was to try to indentify the manganese sources used by tile makers at that time and to determine the recipes for the purple/black glazes. Manganese ores were usually local ones, so we hope to be able to determine the colour provenance.

Functional properties of kitchenware from Uruk (Iraq)

Malgorzata Daszkiewicz[1)], Ewa Bobryk[2)], Margarete van Ess[3)]

[1)] ARCHEA, Warszawa, Poland;
[2)] Warsaw University of Technology, Warszawa, Poland;
[3)] German Archaeological Institute (DAI), Berlin, Germany;

This paper presents analysis of the function of kitchenware based on the assessment of its water permeability. If cooking is defined as the softening of foodstuffs using boiling water, then to decide if a pot is suitable for this purpose we need to evaluate its water permeability and thermal shock resistance. Water permeability was gauged on samples of 20mm in diameter cut from pottery sherds with both inner and outer surfaces well-preserved. Before the first measurement the samples were boiled in distilled water in order to remove secondary contamination from their open pores. Once measured, the samples were dried and then heated at a temperature of 400°C in air, in order to remove any organic substance left behind through its use or as a result of intentional impregnation. After this second measurement the sample was dried once again and finally, subjected to tenfold thermal shock at DT = 400°C using water at room temperature as a cooling medium. Additionally two measurements of wet samples have been made. Water permeability thus was measured five times. For this study pottery from excavations in Uruk (Iraq) dated from 4th to 1st mill. B.C was used. The material of all samples was determined using three independent methods: MGR-analysis, chemical analysis by WD-XRF, thin-sections. The results show that in every period thermal resistant kitchenware very well suited for cooking could be distinguished from kitchenware which could not have been used as cooking pots.

Two pottery kilns from Aventicum (2nd century AD, Ct. Vaud, Switzerland): Raw materials and temperature distribution

Giacomo Eramo[1)], Marino Maggetti[2)]

[1)] Università degli Studi di Bari "A. Moro", Bari, Italy;
[2)] Université de Fribourg, Fribourg, Switzerland;

Twenty-one oriented samples from the fireboxes of two pottery kilns (St.6 and St. 180), excavated 2002 at Aventicum (actually Avenches), the capital of Roman Switzerland, were analysed. Petrographical, mineralogical and chemical analyses constrained the nature of their building raw materials and the temperature distribution as recorded by the relict structure.

Both kilns are typologically different and show differing degrees of thermal effects. For kiln St.6, inferred maximum temperatures were, as deduced from the phase associations, as high as 1050-1200 °C. Such high temperatures are typically recorded in the fireboxes of ceramic kilns (Maggetti, 1995). Contrasting, kiln St. 180 is supposed to have been a drying oven, as evidenced by: (1) its phase associations, indicating maximum firing temperatures of 950-1050°C, and (2) its unusual shape.

Seven clay samples from the same site were also analysed in order to check their compatibility with the firebox samples. They are CaO-rich - but the Roman potters built both kilns with CaO-poor bricks and CaO-poor clay binders. This choice is most probably motivated by the fact that such “refractory” clays are better suited to withstand higher firing temperatures and for a longer period than CaO-rich clays. This result excludes the use of the clay collected in the excavation area as raw material and points to other local clays poor in CaO (Jornet, 1982; Sigg et al.,1986).

The double barreled handle of the East Aegean transport amphora - stylistic trademark or functional innovation

Viktoria Georgopoulou[1)], Anno Hein[2)], Vassilis Kilikoglou[2)]

[1)] Alimos, Greece;
[2)] Institute of Materials Science, National Centre for Scientific Research "Demokritos", Athens, Greece;

Starting point of the present research was the study of Hellenistic transport amphorae from Kos. The Koan amphora production is mainly distinguished by a characteristic vessel shape presenting double barreled handles, although the archaeological research on the island attested the simultaneous production of the single handles. While single handles with elliptic cross-section appear to have been the most common choice elsewhere, Koan potters favored the more elaborate double barreled handles apparently in order to distinguish their production from others. However, most probably they did not invent the characteristic double barreled handles, but they rather adopted them. The first use of the double barreled handles is attributed to the Archaic Milesian transport amphora. The compositional variation and diversity of the Archaic Milesian amphoras pointed to the existence of different places of manufacture under the Milesian influence. Among these places Kos is assumed as a potential production place, since a number of amphoras of this type have been discovered in the Archaic tombs of Kos representing possibly local products. Moreover, during the Late Hellenistic Period the shape of the Koan amphora with its double barreled handles is reported to have provided an archetype for amphora production in other regions. Therefore, the aim of this paper is to understand and explain the preference of this type of handles either in terms of technical benefits or simply in terms of a decorative element, related to a specific variation of Koan wine.

Archaeometric investigations of the Neolithic pottery discovered at the funerary complex from Alba Iulia-Lumea Noua (Romania)

Mihai Gligor[1)], Simona Varvara[1)]

[1)] "1 Decembrie 1918" University, Alba Iulia, Romania;

The settlement from Lumea Nouă is situated in the north-est of Alba Iulia town (Alba County). The results of the archaeological research were indicative of intense habitation belonging to the Foeni group. Human bone remains from approximately 100 people were buried in this area, probably a larger number of skulls than of whole skeletons. The chronological timeframe from C^{14} data analysed spans between 4600-4450 BC. The archaeological material discovered in association with the bone remains is in principal pottery. Foeni communities produced very good quality pottery, by using fine clay without impurities. Significant quantity of well burnished vessels, some of them black-topped fired, was found. Painted decorations applied on the vessels before firing are also typical. The present research focuses on the characterization of the Foeni pottery aiming to establish the production technology in terms of the raw materials used and firing procedures. A multi-analytical approach has been adopted: chemical, mineralogical, and petrographic features of the ceramic bodies were determined by XRF, XRD and optical microscopy.

Research founded by the project “The Social-Humanistic Sciences in the Context of the Globalized Evolution: the Development and the Implementation of the Post-Doctoral Studies and Research Program”, contract code POSDRU/89/1.5/S/61104, co-financed from the European Social Fund through The Sectoral Operational Program for Human Resources Development (2007-2013).

Analyses of the white barbotine decoration of two Roman pottery groups

Eszter Harsányi[1)], István Sajó[2)], György Szakmány[3)], Zsolt Bendo[3)]

[1)] Archäologisches Landesmuseum Baden-Württemberg, Rastatt, Germany;
[2)] Chemical Research Center, Hungarian Academy of Sciences, Budapest, Hungary;
[3)] Department of Petrology and Geochemistry, Eötvös Loránd University, Budapest, Hungary;

The white barbotine is a very rare decoration form in Roman pottery production. It was applied on three main pottery groups from the 2nd to the 4th century: on the Samian ware from Rheinzabern, on the black coated ware from central Gaul and on the so called motto beakers from Trier. Surprisingly this kind of decoration has been not analysed so far with natural science methods. As a part of a research on the black coated ware from Trier in Pannonia some motto beakers were analysed with XRD, petrographic and EDS-EDAX methods. These analyses showed that the raw material of the white barbotine decoration is white clay, which was fired on high temperature and his decoration is not joined very firmly to the black coat on the sherd. This fact and the 100-150°C difference between the firing temperature of the sherd and the white barbotine, and the porous condition of the latter allude to a special technique: the white clay was first fired on a high temperature, and then it was crushed, mixed with a binder and applied onto the surface of the coated and fired pottery. Whether this technique was unique in the Roman Empire will be shown by the new results of similar analyses of some samples of the Samian ware from Rheinzabern.

Sassanian pottery of northeastern Iran: Classification, comparison, and interpretation based on attributes of form

Meysam Labbaf-Khaniki

University of Tehran, Tehran, Iran;

Studying the pottery of Sassanian Iran provides possibilities for archaeologists to challenge the local tradition in ceramic production, in one hand and understanding the stylistic interplay between regional ceramic complexes in other hand. Moreover, it helps archaeologist via interpreting the type and style of pottery to recognize socio-economic interactions between cultural spheres. Nevertheless, the Sassanian pottery from Northeastern Iran has been studied in few researches limited to some interim reports of archaeological excavations or surveys. In this paper, after describing the indicative attributes of ceramics of Northeastern Iran and classification of Sassanian ceramics, I suggest some indications for Sassanian pottery and review the local traditions in ceramic production. Ceramic sherds obtained from the four major late- Sassanian sites including Nishapur, Bandian, Tape Hisar, and Toreng Tape construct the foundation of the interpretation and comparison with other assemblages initiate pottery tradition of Iran during late-Sassanian period.

Aforementioned sites belong to second half of Sassanian period and understanding the late-Sassanian pottery helps us to solve crucial problem of recognition differences between early Islamic and late Sassanian pottery.

Patterns of incised or painted wavy lines on ritual vases from Dra Abu el-Naga

María José López-Grande

Universidad Autónoma de Madrid, Madrid, Spain;

The fieldwork carried out by the Spanish expedition at Dra Abu el-Naga since 2002, has uncovered an important amount of pottery remains. Amongst them, those which allude with plastic and/or incised and painted decoration to the wet goddesses are particularly striking. The study of their decoration, found mostly in jars but identifiable also in bowls and dishes in both silt and marl wares, deserves a comprehensive study. A fine collection of decorated vessels and sherds with modelled female breasts, some of them with hands, and/or continuous or broken wavy lines patterns has been attested. The peculiar design of the wavy lines, its variation on styles and execution techniques will be treated in particular as it seems to involve a deep significance related to the funerary ceremonies offered to the deceased at the time of their burials and later, in order to assist them in their eternal life. For one thing, the wavy lines pattern seems to be part of the African heritage of ancient Egyptian culture, besides its wavy design should evoke the most precious liquid food for the eternal life, the milk. And then there is the hair of the goddesses, which also was of great significance in the rituals for the afterlife and should also be evoked with the incised or painted wavy lines patterns attested in these vessels.

Application of a portable and handheld Niton XRF analyzer in studying of ceramics and histrocial bricks in Hungary

Zoltán May[1)], Maria Tóth[2)], János Szépvölgyi[3)]

[1)] HAS Chemical Research Center, IMEC, Budapest, Hungary;
[2)] Hungarian Academy of Sciences, Budapest, Hungary;
[3)] Research Institute of Chemical and Process Engineering, Veszprém, Hungary;

A portable and handheld NITON XRF analyzer (XL3t 900, equipped with a portable and refillable He-cylinder) was invested by our research group a few years ego. This technique is a novel one in field of archaeometry in Hungary and there is a great demand for it. Firstly we have planned to map the possibilities and limitations of this instrument, studying the effects of parameters such as sample type (metal, alloy, ceramic, glass), sample geometry (especially the surface curvature), matrix effects. During this studies we have measured reference materials (soil and rock), then many artefacts such as terra sigillata samples, ancient alloys and historical bricks and some type of glazes. Comparison between our results and that of measured conventionally (non portable, benchtop XRF) is in progress also. Historical stamped bricks and terra sigillata samples have been studying by means of this XRF instrument on the spot. Best results can be obtained in case of samples with even, clean and non bended surface where the gap is minimal between the sample and the detector. Now we have two main sources of brick samples: Győr (former name of Arrabona) and Aquincum (in the area of former Pannonia province) wich are representative area of brick making of the ancient Roman Empire. Our main goal is to investigate differences of raw materials of this two area, to find various features of making technology and do provenance studies by measuring main and trace elements of these numerous artefacts. This work is supported by Hungarian Scientific Research Fund (OTKA) PD 75740.

Ceramic production at Sai Island (Northern Sudan): raw materials variability and technological choices

Italo Maria Muntoni[1)], Giulia D'Ercole[2)], Giacomo Eramo[3)]

[1)] Soprintendenza per i Beni Archeologici della Puglia, Centro Operativo per l'Archeologia della Daunia, Foggia,Italy; [2)] Corso di Dottorato in Archeologia Preistorica, Sapienza Università di Roma, Roma, Italy; [3)]Dipartimento Geomineralogico, Università degli Studi Aldo Moro, Bari, Italy ;

Petrological (OM), mineralogical (PXRD) and chemical (XRF) analyses were carried out on 56 ceramic and 16 pelitic samples collected from four prehistoric sites, with different chronological and cultural contexts, on Sai Island in the Nile river (northern Sudan).

Sai Island is characterized by the presence of eroding beds of Pleistocene and Holocene silts and gravel bars from Nile paleochannels, punctuated by small outcrops of schist and quartz. A sub-surface calcium-rich mudstone underlies sediments in many parts of the island.

Archaeometric data suggest a substantial change through the cultural sequence both in the selection of clayey raw materials and in the technological choices related to pottery production. Qtz-Kfs fabric from the oldest horizon (Khartoum Variant, 7000-5000 BC) was made using primary clays, probably collected next to the island's small schist and quartz outcrops, without adding organic temper. Qtz-Pl Abkan (5000-4000 BC) and Pre-Kerma (3000-2600 BC) fabric shows a different origin from sedimentary/secondary clays. In this fabric organic inclusions (dung and/or vegetal fibres and/or charcoal fragments) were frequently observed.

There are also significant technological differences between pottery from the same chronological and cultural horizon: a larger amount of organic inclusions was identified in the Qtz-Pl Pre-Kerma samples from granary site 8-B-52A in comparison to those from settlement site 8-B-10A. This could be explained as a specific functional choice in relation to the use at the former site of large pots as storage containers for wild and domestic grains.

Archaeometrical study (mineralogy, chemistry and petrography) of Neolithic ceramic sherds from Mfomakap (Central province, Cameroon)

Zoila Luz Epossi Ntah[1)], Robert Sobott[1)], Klaus Bente[1)]

[1)] Universität Leipzig, IMKM, Leipzig, Germany;

Mfomakap is situated in the Central Province of Cameroon (Lekie Division) in the forest belt of Central Africa. Neolithic ceramic sherds (2000 BC) were collected together with raw materials from three pits situated in the vicinity of the excavation zone. The aim of this work is to determine the provenance of the ceramics. The analytical methods used are X-ray fluorescence (XRF), optical microscopy (OM), X-ray diffraction (XRD). A number of 30 ceramic samples were studied. The OM shows that the temper is constituted by quartz, K-feldspar, hornblende, biotite and plagioclase. The matrix is brown coloured, quite homogeneous, semi-isotropic and mica-rich. The phases identified in all the sherds by XRD are: quartz, biotite, muscovite, microcline (weak peaks) and traces of oligoclase. Kaolinite, hornblende and traces of hematite were found in some sherds. The XRF shows that the sherds contain around 68 % SiO_2, 16 % Al_2O_3, 7 % of Fe_2O_3 and 3 % of MgO. The alkali oxides have low content (about 1 %). The mineralogical phases of the three clays are quartz, kaolinite, biotite and microcline. The XRF results for the clays individuate two types of raw material: one rich in SiO2 (average of 83 %) and poor in Al_2O_3 (average of 9.2 %) another poor in SiO_2 (50.3 %) and rich in Al_2O_3 (19. 6 %). A local production of the pottery in this region is suggested. Probably the potters mixed the two types of clay to produce ceramics. The chemical composition of the sherds suggests a proportion close to 1:1. The grain size distribution of the temper and the low content of alkali oxides in the clays (average of 0.3%) compared to that of the sherds (average 1 %) would suggest the introduction of additional temper.

Neolithic pottery from Thessaly, Greece: The social meaning of technology

Vasso Rondiri

13th Ephorate of Prehistoric and Classical Antiquities, Volos, Greece;

Since the beginning of the 20th century "Greek Neolithic" has been identified with pottery studies in Thessaly, in an attempt to follow geographical paths of prehistoric communities using Thessalian ceramic typology.

During the last decades archaeologists demonstrate an interest in "agency", while studying the past and trying to give interpretations concerning pottery as part of material culture. In particularly, they are dealing with the different forms of social practice and the mechanisms functioning through the role of the agents. They are also interested in revealing relations between agents and their impact on pottery technology. The way leading to interpretations of the above relationship is through the tracing of the potters' technological choices and the effects on pottery production and use.

The role of potters in forming the identity of neolithic communities in southern Vietnam

Carmen Sarjeant

The Australian National University, Canberra, Australia;

The study of ceramics from prehistoric southern Vietnam has previously focused on morphological and decorative parallels between sites within the region (Nishimura 2002; Nishimura & Vuong 1997). My current research aims to expand inferences from such comparisons into questions about the nature of interaction between potting groups in southern Vietnam during the neolithic and the role of potters in establishing a regionalised material identity. I also examine the role of potters in the spread of a wider neolithic ceramic expression in mainland Southeast Asia.

The focus of my research is a detailed analysis of the ceramics from a neolithic site in southern Vietnam. An Son is a mound site located on a natural levee in the middle reach of the Vam Co Dong River in Long An province. My analysis covers the morphological, decorative and fabric attributes of the pottery excavated from the site in 2009. A primary objective of this research is to characterise the ceramic technology at An Son in terms of the contexts in which different ceramic vessels were found. I endeavour to develop a systematic way to compare the material culture between different sites of southern Vietnam, and further afield. Comparative data from other neolithic sites in the region is limited and usually relies on illustrations. To circumvent such problems, a correspondence analysis has been conducted on presence or absence data to reveal relationships between archaeological sites, based on their material culture.

XRD and EDX analyzing on 14 standard glaze samples used in Imam Mosque, Esfahan, Iran

Maryam Soltani[1)], Karim Movassaghi[2)]

[1)] Sama technical and training college, Islamic Azad University, Isfahan, Iran;
[2)] Chemistry department in Isfahan University, Isfahan, Iran;

In ancient times many porcelain wares were manufactured in different kinds and usually made of local raw materials. This becomes visible by their chemical decompositions of the body and of the glaze. In this paper similar ceramics from different places have been chosen. 14 glazes samples were scrutinized by X-ray flounces analysis (EDX) and XRD, and the statistical analysis has shown that these samples are related to one historical mosque in Isfahan in Iran.

The results show that green glaze contains less alkali than of the red glazes. It is a relation between SiO_2, Al_2O_3, ratio and the amount of the CaO.

On the tracing of curvilinear patterns on prehistoric vases in south eastern Europe

Dragos Gheorghiu

National University of Arts, Bucharest, Roamania;

The techniques of tracing the patterns covering the surface of prehistoric ceramic vases did not represent a significant topic in ceramic studies, although it could reveal interesting details concerning the rituality of the chaînes-opératoires (Gheorghiu 2011a), offering a new image of the different technical constraints of the ergonomics of vases' construction.

One of the best examples in favour of the above statement is the incised or painted decoration of Neolithic and Chalcolithic ceramics of the South Eastern Europe. At a close reading the incised or painted curvilinear patterns reveal the use of a series of standardized operations, depending on strict mathematic rules (Gheorghiu 2011b).

The present paper will present the mathematical base of these patterns, as well as some experiments in support of a ritual operation of tracing the patterns.

Gheorghiu, D., 2011a, Ritual chains, pp.143-146. In Scarcella, S. (ed.), Archaeological ceramics. A review of current research, BAR International Series 2193, Oxford, Archaepress.

Gheorghiu, D., 2011b, The Decoration of ceramic vases with Bézier curves' templates in prehistoric Europe, pp. 971 – 976. APLIMAT 2011, Bratislava, Slovak University of Technology.

Brown decorations in 10th to 18th centuries Spanish tin glazed ceramics

J. Molera[1)], J. Coll[2)], A. Labrador[3)], T. Pradell[4)]

[1)] Universitat de Vic, Vic, Spain;
[2)] Museo Nacional de cerámica y artes suntuarias, Valencia, Spain;
[3)] LLS, BM16-ESRF, Grenoble Cedex, France;
[4)] Universitat Politècnica de Catalunya, Castelldefels - Barcelona, Spain;

Tin glazed pottery with brown and green (B&G) decorations started being used in the Islamic kingdoms in Spain during the Caliphal period (10th-11th century AD). B&G production has no previous connexions with late-Roman productions, but strong similarities to contemporary North African productions. After the 11th century B&G production decays and nearly disappears until the beginning of the 13th century AD when it starts again in the Islamic kingdoms from where is rapidly transferred to the Christian kingdoms (the very well known productions from Paterna and Catalunya). In Paterna and Catalunya B&G is mainly substituted during the second half of the 14th century by the blue decorated tin glaze ceramics and later by the Italian-like polychrome productions. In Teruel (Aragon) B&G pottery had begun to be important at the end of the 13th century AD and continued until the 20th century1. A very small production of brown decorated tin glaze ceramics reappeared during the 17th century in Catalunya. Brown decorations were also applied over lead glazes in Islamic times (10th century Caliphal productions); green tinged tin glazes were also used in all the Islamic and Christian productions. Finally, brown decorated biscuit fired pottery was also produced since early Islamic times. Some of the earlier Islamic productions (mainly Caliphal and Almohade) usually show a very poor conservation to the point that for some time they were though to be made of a white slip decorated with brown and green paints. The quality and conservation state of the B&G decorated ceramics dramatically improved in the 13th century. A selection of samples covering all the B&G from 10th to late 17th and brown decorated 17th century Catalan tin glaze pottery, as well as, brown decorations over lead glazes and green tinged tin glaze productions are studied by means of SEM-EDS and micro-X Ray Diffraction. Differences and similarities in the nature and microstructure are presented and related to differences in the production process. The sudden change in the quality and conservation state of the B&G production during the 13th century is discussed.

[1]J. Pérez-Arantegui, B. Montull, M. Resano and J.M. Ortega. Materials and technological evolution of ancient cobalt-blue-decorated ceramics: Pigments and work patterns in tin-glazed objects from Aragon (Spain) from the 15th to the 18th century AD. Journal of the European Ceramic Society Volume 29, [12], 2499-2509. (2009).

Technological study of a Renaissance maiolica inkstand made by Giovanni di Nicola Manzoni (Museum of Applied Arts, Budapest)

Bernadett Bajnóczi[1)], Mária Tóth[1)], Gábor Dobosi[1)], Gabriella Balla[2)], Katalin Csontos[2)]

[1)] Institute for Geochemical Research, HAS, Budapest, Hungary;
[2)] Museum of Applied Arts, Budapest, Hungary;

A maiolica inkstand with three-dimensional figures showing “The Nativity” and “The Adoration of the Magi” forms part of the collection of the Museum of Applied Arts in Budapest. The inkstand made by Giovanni di Nicola Manzoni probably in Colle Val d’Elsa (Tuscany) around 1510 has prominent art historical significance due to its narrative scenes, inscriptions, signs, function and quality.

The red-coloured body of object was made of calcareous clay fired at around 850 °C. The body was covered first by a tin-opacified white glaze, then a transparent overglaze. The tin-opacified glaze is of lead-alkali type (21 to 25 wt% PbO, 6 to 7.3 wt% Na_2O+K_2O). Abundant feldspar and quartz particles in the white glaze are sand relicts and indicate lack of prefritting. 3.5 to 6.9 wt% SnO_2 content of the opaque glaze is attributed to cassiterite particles and aggregates scattered irregularly. The overglaze is of lead-alkali type (22 to 29 wt% PbO, 6.6 to 7.3 wt% Na_2O+K_2O) and contains less and smaller sand relicts and fewer bubbles.

Cobalt-nickel-bearing calcium silicate particles at the interface between the glaze layers and 0.5 wt% CoO in the overglaze indicate that cobalt-bearing pigment was used for blue decoration. Iron-bearing lead antimonate particles are present at the interface between the glaze layers in the ochre decorated area. Green decoration is associated with copper. Calcium manganese silicate particles in the overglaze and elevated manganese content in both glaze layers were detected in the brown decorated area.

Capodimonte porcelain: glaze composition and its technological implications

Bruno Fabbri[1)], Sabrina Gualteri[1)]

[1)] CNR, Institute of Science and Technology for Ceramics, Faenza, Italy;

Capodimonte porcelain is a significant Italian production of the 18th century, even though restricted to less than twenty years. In 1760, in fact, the whole manufacture was transferred to Madrid, where the product will be known as Buen Retiro porcelain.

At EMAC’09 we presented a paper on the paste composition of the Capodimonte porcelain. Now we present the study of the glaze composition with its technological implications. The glazes of twenty-three fragments were analyzed through SEM-EDS and microscopic observations in thin section. These observations evidenced that the thickness of the glazes is variable from sample to sample (40 to 150 μm), as well as the chemical composition. It always deals with lead-alkaline glazes characterized by an average SiO_2/PbO ratio of 1.7 approximately. Sodium is the most abundant melting element (4 to 7% Na_2O approximately), while the sum Na_2O+K_2O+CaO exceeds 10% on average. Most glazes contain variable amounts of tin oxide, but only in few cases it exceeds 2% SnO_2.

The above mentioned composition of the glazes is such that it can be inferred that their maturation temperature does not exceed 1000°C, while the pastes have been fired mostly in the range 1100-1200°C. This means that the glaze were applied after the first firing of the paste, when this last was not porous, a part from the closed porosity. Therefore one can suppose that they were applied in form of a slush, rather than by immersion into a slurry of the glaze powder.

Aggregate, binder and wine: archaeometric study of Punic mortars from Sardinia

Elisa Alonso Lopez[1)], Peter van Dommelen[2)], Ian Whitbread[1)]

[1)] University of Leicester, Leicester, United Kingdom;
[2)] Glasgow University, Glasgow, United Kingdom;

The characterisation of mortars and plasters used at the rural Punic site of Trunc' 'e Molas (Sardinia, Italy) for lining the walls of a wine basin and conditioning building walls has been carried out by Micro X-Ray Fluorescence (μ-XRF) and optical microscopy (OM). The petrographic results combined with elemental mapping are used to identify the nature and manufacturing technique of the mortars and plasters.

In parallel with these analyses we are examining ceramics from the site in order to explore technological connections between the two classes of materials. This is possible due to ceramic inclusions being used as aggregate in the hydraulic mortar of the wine basins. The results show that these ceramic inclusions were being selected with care by the basin builders who had a clear understanding of the ceramic properties and technology necessary to achieve a durable product, a successful hydraulic mortar, when several types of ceramic fabrics were available.

The use of μ-XRF technology makes it possible to analyse individual inclusions, such as lime lumps and interaction areas, in the mortar without destroying the sample. This allows direct comparison between elemental data and the thin section.

Technical ceramics for glass annealing in the forest glassworks of Derrière Sairoche (Court, Swiss Jura): Provenance determination and functional analysis

Giacomo Eramo[1)], Elena Zanella[2)], Jonathan Frey[3)]

[1)] Dipartimento Geomineralogico, Università degli Studi di Bari "A. Moro", Bari, Italy;
[2)] Università degli Studi di Torino, Torino, Italy;
[3)]Archäologischer Dienst des Kantons Bern, Bern, Switzerland;

The glassworks of Derrière Sairoche (1699-1714) produced drinking glasses, little bottles and bull's eye panes with lime-potash composition (forest glass). The present contribution reports the archaeometric characterisation of 39 potsherds of a particular pottery class found in the archaeological excavation of the glassworks all around the melting furnace. They underwent to petrographical, mineralogical (XRD), chemical (XRF) and thermoremanent magnetization (TRM) analysis to determine the provenance of these artifacts and verify the archaeological hypothesis of their use as technical ceramics. The petrofacies expressed by the pottery is not compatible with that of the local clayey sediments and their provenance is supposed to be Ajoie or Alsace. Contrary to what happened for the glass crucibles and the building materials of the melting furnace, this technical ceramic was imported. The mineral content and fabric of the potsherds point to a maximum temperature of firing between 900 °C and 1100 °C, while The demagnetization path of each sample obtained by TRM analysis revealed more or less complex thermal histories which goes from the samples carrying only primary TRM (500 °C and 580 °C) to the samples showing both primary and secondary TRM (150 °C – 450 °C). These results show the use as technical ceramic at temperatures even above 580 °C, but below their firing temperatures. As a whole, temperatures exceeding 580 °C should not be referred to the firing of the vessel, but to the heating occurred during their use to anneal potash-lime glass at about 700 °C. The heterogeneous temperatures recorded may be ascribed to different position of the samples in the vessel and of the same vessels in the annealing chambers.

Cucuteni Neolithic Ceramic: Research and Restoration - Conservation

Maria Geba[1)], Nathalie Huet[2)], Senica Turcanu[1)], Ana-Maria Vlad[1)], Codrin Lacatusu[1)], Arina Husleag[1)], Ligia Teodor[1)], Manuela Dascalache[1)]

[1)] Moldova National Complex of Museums, Iasi, Romania;
[2)] Université de Rennes, Rennes, France;

The Neolithic ceramics of Cucuteni, about 5000 year-old, is part of the wider complex of Ariusd-Cucuteni-Tripolie, in the southeast of Europe. This type of three-color painted ceramics was the object of a cooperation project between France and Romania, funded through the Brancusi Program, and which was aimed at studying the ceramic paste, burning temperature, pigments (white, red and black) used for the ornamentation of the ceramic items, modeling of the shape of the items, etc. The paper shall describe the result of the petrographic analyses, SEM – EDX, XRF obtained on ceramic fragments of the Cucuteni civilization from the A, AB and B phases of evolution, which were discovered in the archaeological site of Scanteia, Targu Frumos, Ruginoasa, Cucuteni, Isaia, Poienesti from Romania. Also the paper will present the restoration - conservation of very important and beautiful Cucuteni ceramic fragments from the Research and Restoration - Conservation of Cultural Heritage Centre, Moldova National Complex of Museums, Iasi, Romania.

The medieval lead-glazed pottery from Nogara (Verona, north-eastern Italy): A multi-methodological study

Lara Maritan[1)], Sarah Maltoni[1)], Alberta Silvestri[1)], Gianmario Molin[1)]

[1)] Department of Geosciences, University of Padova, Italy;

The present work focuses on the archaeometrical characterization of X-XI centuries lead-glazed pottery from Nogara (Verona, north-eastern Italy), with the aim of defining both the glaze and clay body production technology through a multi-methodological approach.

All the glazes are transparent, yellow to green in color, 20 to 100mm thick, texturally homogeneous and variable in composition, with high lead content (PbO: 53-76 wt%), variable silica (SiO_2 :17-31 wt%), low alumina (Al_2O_3 : 4-7wt%) and alkali (Na_2O+K_2O: 0.6-1.7 wt%) and iron playing as colorant (FeO about 2 wt%). The ceramic bodies are illitic non-calcareous clay-based, the textural features of which indicate neither depuration or tempering, and firing temperatures generally under 850°C. Microstructural, chemical and mineralogical evidences both in glaze and ceramic body suggest that Nogara glazes were produced applying on the unfired ceramic body a flux of lead compound, which causes partial melting and chemical diffusion phenomena in the ceramic body. The presence of small (5 mm) newly-formed K-Pb feldspars crystallites at the body-glaze interface, indicates fast cooling rates. The glaze colour, related to the cromophorous FeO, has to be considered unintentional. Chemical analogies between Nogara samples and glazed pottery from various sites differing in age indicate routine production processes resulting in a glaze of consistent composition, over the centuries, from whatever archaeological sites the samples come.

Characterization and conservation of 17th century Portuguese glazed ceramic tiles: A case study

Shari Almeida[1)], Márcia Vilarigues[1)], Augusta Lima[1)], Ana Duarte[2)]

[1)] Universidade Nova de Lisboa, Caparica, Portugal;
[2)] Ecomuseu do Seixal, Seixal, Portugal;

In this work, a panel of glazed ceramic tiles (Azulejos), dating from the end of the 17th century, was studied and submitted to a conservation treatment. The panel was made in the majolica technique and depicts a maritime scene painted in blue, purple and brownish-purple on the white glaze. The main objectives were to characterize the production technique and to perform an adequate conservation treatment in order to prepare the panel for exhibition. The panel showed evidence of previous conservation interventions and consequently it was crucial to identify the different materials used in the past to define the most adequate conservation methodologies. One important part of this work consisted in the discussion of the different restoration hypothesis, concerning the large number of missing areas existing in the tiles, based on the Ethics of Conservation, regarding especially volumetric and chromatic infills. A multi-analytical approach, including Energy dispersive X-ray fluorescence spectrometry (μ-EDXRF), Fourier transform infrared spectroscopy (FTIR), Raman microscopy and optical microscopy was used. Through FTIR analysis it was possible to identify polyvinyl acetate, Paraloid B-72 and ethyl silicate, related to previous treatments. Raman and μ-EDXRF analysis showed that tin was the opacifier used in the white glaze, cobalt and manganese in the blue and purple painting, respectively. The brownish purple outline is given by iron oxides, and not by manganese as is commonly accepted. With this work we expect to provide relevant data on the production technique of Azulejos dating from the end of the 17th century and also contribute to extend the knowledge on the materials and methodologies used in the conservation and restoration of glazed ceramic tiles.

The project of conservation and restoration due to fading of glaze in the seven-colored tiles of Imam Ali's Holy shrine, Najaf,Iraq (based on laser technique)

Shadi Soltanzadehl[1)], Abdol Rasool Vatandoust[1)]

[1)] Tehran Islamic Azad University, Isfahan, Iran;

The Holy tomb of Imam Ali (greetings upon him) and its inside decoration have confronted various changes during the years, and received damages. One of the most significant damages that has occurred was on the seven colored tiles that faded and their enamels (glaze) blurred.Regarding the performed investigation with respect to technical point of view, it was determined that Cobalt Oxide has formed the blue color and due to pathology and experimental tests (XRD,SEM) the fact appeared to be that reason for fading was not due to exitting of cobalt oxide from the crystalline network on the enamel. Then through microscopic studies, it was defined that the fading is because of the chipping of the enamel from the surface of the tiles. This damage could be due to climatic conditions in the city of Najaf, and blowing of sand storms. Finally for restoring and renovating the enamels, the theoretical use of laser as a source of energy was considered. The base for this theory is restoring the crystalline network of the enamel by using pure Silicon powder and also mixed with Cobalt Oxide and applying carbon dioxide laser equipment.

The performance of different adhesives for archaeological ceramics under mechanical stress

Konstantinos Alexiou[1)], Ioannis Karatasios[1)], Noémi Suzanne Müller[2)], Vassilis Kilikoglou[1)]

[1)] N.C.S.R. "Demokritos", Athens, Greece;
[2)] University of Barcelona, Barcelona, Spain;

Large ceramic items such as storage jars pose a challenge to conservation; not only due to their size, but also because of increased requirements they pose on adhesives as compared to smaller vessels. Failure to meet these requirements have been observed to results in shape distortions, self-loaded deformations, which - when untreated - ultimately lead to vessel collapse. This problem is aggravated under highly fluctuating environmental conditions such as frequently encountered in the Mediterranean.

Archaeological ceramics exhibit differences in microstructure and mechanical properties: so tends low fired pottery to be more fragile and porous, while higher fired ceramics are usually stronger. When reconstructing fragmented ceramic vessels during conservation, normally the same type of adhesive is used for joining sherds, regardless of the ceramic type. However, the adhesive bond with the ceramic and ultimately the performance of the composite under static loading depends also on the ceramic's microstructure, while failure mechanisms are influenced by the ceramic's mechanical properties and the adhesive strength.

To assess the performance of adhesives joining various archaeological fabrics, a series of systematic tests on various adhesive-ceramic systems were conducted. Due to the destructive nature of tests, different types of selected comparative ceramics were joined with commercially available adhesives with different viscosities and strength. Their response to static mechanical stress was assessed in controlled loading tests and their failure mechanisms were studied. We present and discuss the results in view of conservation requirements such as adhesive strength, joint reversibility and risk prevention.

Archaeometric characterization of 17th century tin-glazed Anabaptist (Haban) faience from NE-Hungary

Bernadett Bajnóczi[1)], Mária Tóth[1)], Géza Nagy[1)], Zoltán Maay[1)]

[1)] Institute for Geochemical Research, HAS, Budapest, Hungary;
[2)] Institute of Materials and Environmental Chemistry, HAS, Budapest, Hungary;

Production of tin-glazed earthenware (faience) in Central Europe was established by Anabaptist (also called Haban) potters in the 16th century. Archaeological excavations of a 17th century cannon casting workshop in Sárospatak (NE-Hungary) revealed tin-glazed artefacts, some of them are decorated with typical Haban motifs. Since no contemporary written sources exist about the production technology of Anabaptist pottery, the goal of our research is the identification of raw materials used and reconstruction of the production technology.

The body of the pottery is made of calcareous clay (14 wt% CaO) fired at around 800 to 850 °C . The tin-opacified white glaze is of lead-alkali type (17 to 26 wt% PbO, 5.2 to 7.2 wt% Na_2O+K_2O according to EMPA analysis). The glaze has tin content of 16 to 22 wt% SnO_2. Cassiterite is present in two forms in the glaze: larger particles with angular shape and aggregates made of smaller needle-like particles. Undissolved quartz and feldspar particles are relicts of sand added to the glazing mixture. Some pottery have blue tin-opacified glaze with similar tin content as the white ones and cobalt was used for colouring.

Yellow, blue, green and black decorations were made by using coloured lead-alkali glazes. Blue glaze contains cobalt with arsenic, nickel and iron suggesting the use of zaffre. Yellow glaze contains lead antimonate particles with iron. Copper colorant was used for green glaze and manganese colorant for black glaze. Microstructure of glazes indicates that decorations were applied over the unfired opaque glaze.

Archaeometrical analysis of colored pigments used in pottery decorations during the Early Italian Neolithic: some examples

Marzia Gabriele[1)], Marta Colombo[1)]

[1)] Università di Pisa, Pisa, Italy;

This work aims to provide some information about the nature of the colored pigments sometimes used to fill engraved or impressed decorations which are characteristics of the different facies of the Early Italian Neolithic.

For this reason sherds were sampled from different Cultures and geographic areas:

- Ripatetta (Puglia): Impressed Ware Culture
- Grotta dell'Orso (Tuscany): Cardial and Linear Ware Culture,
- Catignano and Colle Cera (Abruzzo): Red Banded Ware Culture,
- Pianosa (Tuscany), Grotta Patrizi and Grotta delle Settecannelle (Latium): Linear Ware Culture.

Analyses were performed by a Scanning Electron Microscopy (ESM) and they pointed out the frequent use of "ochre" (iron oxide), although in Tuscany and Lazio cinnabar is sometimes found.

Historical tiles conservation

Maryam Soltani

[2)] Sama technical and training college, Islamic Azad University, Isfahan, Iran;

Historical objects have always been vulnerable to inner and outer destructive factors. Detecting these factors may help us to choose the best protective and conservative method and approach.

Internal destructive factors of historical ceramics include poor condition of glazing, poor quality of ingredients and structure of ceramics. The external factors are touching the ceramics, humidity, high temperature, air pollution and biological factors.

The aim of this study is detecting the destructive factors and finding the proper method to protect, conserve, maintain, strengthen and cleaning the ceramics.

Analytical Study of the dancing human motives of fourth millennium B.C. potteries in Iran

Sedigheh Ghoraeian[1)], Sima Yadollahi[1)]

[1)] University of Teheran, Teheran, Iran;

Cognitive Archaeology is one of the specific branches of archaeology which study all aspects of ancient cultures that are the creation of the past peoples. Ritual and symbolic aspects of the prehistoric human life has always been one of the most controversial issues in the archaeological studies and has attracted many archaeologists' attention.

For studying human intellectual and symbolic behavior, choosingright and related objects, play an important role in getting more sensible results. Amongst all objects which have been obtained from archeological excavation potteries may be the most and best objects which can provide archeologists suitable data. Amongvariousexcavatedfourth millennium B.C sites in Iransome potteries have been discovered with motives of dancing humans which are most probably are in relation with their cognitive motives.

This article firstly is to study variety and dispersion of these motives among Iranian prehistoric potteries, classifying the potteries and their motives, and then it tries to realize the relation between these motives symbolic meaning and their ritual and symbolic aspects of their creators by using archaeological methods and approaches. Styles and symbols in particularin this research used to create a link between archaeological data and their creators'cognitive systems.

Using of amphorae as building material for graves at Viminacium

Snezana Golubovic

Archaeological Institute, Belgrade, Serbia;

Huge salvage excavations were conducted from 1977 at the territories of southern and eastern graveyards of Viminacium and over 14 000 graves has been explored until now.

Throughout centuries at this area, along with the city and military camp, a number of cemeteries have been established for the burials of heterogeneous population of antique Viminacium. Following roman customs graveyards were formed out of the town, probably along the communication leading to the city. This huge necropolis contains parallel burial, both of the cremated and skeletal remains of the deceased.

There are a certain number of graves in which were found whole examples or pieces of amphorae used as recipients for burials or together with bricks as the material for grave construction. Considering inhumations, in one case half of amphorae were used as a cover for adult male while there were few newborns or children till one year old buried in whole amphorae.

The most frequent grave form with cremated remains of deceased at Viminacium was so called en étage pit, usually with the red and grey 2-5 cm thick, and heavily burned walls. Their appearance are dated to the end of I century and continued till the middle of the III century. Recently has been explored one grave of cremated deceased with three levels which second level was built of bricks and amphorae fragments. Bricks were with the stamp of a legion while on three fragments of amphorae rim were also found stamps. V arious grave types are pointing out at the complex ethno-cultural situation and particularly for this type is difficult to relate to a specific ethnical element. Therefore, not only the objects placed in grave but also material for the building could contribute in enlightening the acculturation process considering autochthonous population with new settlers representing relations in the multi-ethnic city of Viminacium.

Mineralogical examination of smelting crucibles and coin moulds from Late Iron Age (La Tène) sites in Western Slovakia

Milos Gregor

Geological Institute, Faculty of Natural Sciences, Comenius University, Bratislava, Slovakia;

The metallurgical processes linked to metal production and minting coins required specific ceramic material, which could withstand the high temperatures achieved during the smelting of metal. Numerous artefacts from excavations in Bratislava, Čierna Voda and Topoľčany revealed Late Iron Age (La Tène) workshops connected with working metals, particularly iron, copper or silver. Fragments of smelting crucibles and slags were amongst the most common finds in these workshops. In contrast, coin moulds are rather rare. The shapes of crucibles are very similar to each other, but their mineralogical composition differs significantly. Fragments from Bratislava and Topoľčany show a high content of graphite, those from Čierna Voda show a high content of quartz grains. The study revealed that the crucibles containing graphite were used repeatedly, whereas the durability of crucibles containing quartz was limited. The crucibles were exposed to temperatures ranged from 1000-1100 °C and they were assumed to be used for smelting copper, as the temperature is in good correlation with its melting point. The presence of copper oxides or carbonates confirms this hypothesis. Workshops connected to minting coins were excavated only in Bratislava. All coin moulds are composed of fine to semi-fine illitic clays and their thermal alteration is variable. Coin moulds fired at 700-800 °C were not further used for casting blanks, but an estimated temperature over 1000 °C may suggest that preparing of coin blanks was possible. The presence of chlorargyrite in coin moulds fired over 1000 °C confirms that silver coin blanks were prepared in them.

Alteration of lead-glazed ware and amphorae from shipwrecks in the Black Sea (Ukraine)

Lara Maritan[1)], Yona Waksman[2)], Michele Secco[1)], Giulio Isacco Lampronti[3)], Claudio Mazzoli[1)]

[1)] Department of Geosciences, University of Padova, Italy;
[2)] Laboratoire de Ceramologie, CNRS UMR 5138, Maison de l'Orient et de la Mediterranee, France;
[3)] Department of Chemistry, University of Bologna, Bologna, Italy;

The present research deals with the mineralogical and microstructural characterization of alteration products on pottery found in Late Roman and Medieval shipwrecks at Novy Svet and Plaka (Black Sea , Ukraine). The shallow-marine environment associated with intense bacteria activity established lagoon-like chemical-physical conditions. Such a burial environment caused potsherds to undergo transformations which determined the alteration of both chemical and mineralogical compositions. A selection of lead-glazed ware ("Novy Svet Ware") and amphora fragments (LRA1, "carrot" and Günsenin 3 types) were here analyzed along crosscutting profiles with a multi-analytical approach, consisting of a combination of optical microscopy, X-ray powder diffraction (XRPD) on micro-drilled samples, and scanning electron microscopy (SEM) provided with EDS analysis. The main aim of this research was the determination of secondary mineral phases, formed during burial in the specific environment of the Black Sea , in ceramic materials differing in terms of porosity and texture, and the thermodynamic and kinetic modelling of the alteration process. In addition, the chemical composition of the studied potsherds, determined by X-ray fluorescence (XRF), was compared with that of reference groups for the same type of pottery coming from terrestrial contexts, in order to evaluate the influence of alteration on the bulk composition. Mineralogical and microstructural evidences indicate that potsherds underwent complex and multi-step transformations related to a progressive change in pH and pe, causing initial formation of framboidal pyrite after hematite and subsequent pseudomorphic crystallization of secondary hematite after pyrite in the outermost layers.

New Assessment of the terra sigillata glosses: The role of LA-ICP-MS

Marisol Madrid i Fernandez[1)], Javier G. Iñañez[1)], N. Jiménez[2)], Jaume Buxeda i Garrigós[1)],R.J. Speakman[2)]

[1)] Universitat de Barcelona, Barcelona, Spain;
[2)] Museum Conservation Institute, Maryland, USA;

Terra sigillata represents the most important fine ware during the Roman period. This ware was widely produced and traded all over the Roman Empire (2nd BC to 7th AD). However, the highest peak of its quality and diffusion is dated back to Early Empire period (late 1st BC to end 1st AD), highlighting Italian, Gaulish and Hispanic productions. From a technological point of view, terra sigillata is characterized by a redness paste and gloss, which shows aesthetic and waterproofing features as main characteristics. Analytically, this kind of glosses is problematic due both to their little thickness (between 10µm and 20µm) and the impossibility to separate them from the matrix completely. Although application of other analytical techniques like XRD or SEM has already been used, time consuming in the preparation of the samples and in the analytical process traditionally has not allowed studies with a statistically significant number of samples.

The aim of this paper is to present the results of the work conducted on the glosses of a large number of individuals of Italian, Gaulish and Hispanic terra sigillata by means of LA-ICP-MS in order to assess the potential of this technique for this kind of studies and materials.

Ascertaining the degradation state of ceramic tiles: A preliminary non-destructive step in view of conservation treatments using gamma radiation

Teresa Silva[1)], Maria-Ondina Figueiredo[2)], Maria-Isabel Prudêncio[3)]

[1)] LNEG-Unity of Mineral Resources and Geophysics, Amadora, Portugal;
[2)] CENIMAT/I3N, Caparica, Portugal;
[3)] ITN, Sacavém, Portugal;

Conserving the cultural heritage is a general concern and the use of non-destructive techniques to characterize ancient materials is mandatory. Important deterioration effects in environmentally exposed ancient glazed ceramic tiles arise from the development of micro-organisms (algae/fungi) within the pore system. Subsequent biodegradation processes are particularly harmful once the decorated glaze is damaged by exfoliation/detachment.

Three case studies will be addressed: Portuguese polychrome decorated tiles from the interior of two churches (17th cent.) and from the outdoor of a Palace (18th cent.). Small tile fragments were directly irradiated in a wavelength-dispersive X-ray fluorescence spectrometer for glaze chemical characterization and subsequently irradiated in a powder diffractometer to assess the phase constitution of both glaze and ceramic body.

Cleaning and conserving these ancient cultural artefacts involves a decontamination process applying innovative non-destructive techniques. The present work is intended as a contribution to diagnose the actual degradation state of ancient tiles in view of future decontamination actions using gamma radiation.

Work developed under project RADIART (PTDC/HIS-HEC/101756/2008) financed by FCT-MCTES.

Introducing different kinds of decorations historical ceramics in Iran

Maryam Soltani[1)], Mohammad Ghalijaei[2)]

[1)] Sama technical and training college, Islamic Azad University, Isfahan, Iran;
[2)] Research center, Isfahan, Iran;

The art of Pottery, due to its popularity undergoes climate, historical, economical and cultural features of the people. The techniques used for making pottery objects from the view point of technology, shapes, colors, decoration is representative of and Imagination power of the producers. The human handmade products have been very simple without any decoration or glaze cover. But gradually the producers learn how to decorate the dishes. The pottery use has been seen for the first time in bricks of Choghazanbil temple in Second millennium BC in Shoosh.

This article tries to introduce different types of glaze decorations on historical potteries including pour glaze, carving under glaze, monochrome glaze and…

And also it tries to introduce the older potteries such as Koobachi, Iznik, Gamberoon, and white and blue dishes dating back to 10 and 15 centuries from that on the pottery making was deterioted.

Incrustated ancient ceramics: one purpose - multi methodological answer

Veronika Szilagyi[1)], V. Leno[2)], J. Mihály[2)], Lázlo Csedreki[2)], C. Berthold[2)], M. Toth[2)], Zsófia Kertész[2)], Z. Szikszai[2)], Zs. Török, E. Furu, D. Schöckle, C. Luthard, P. Csengeri, K. Biró[3)]

[1)] Institute of Isotopes, Hungarian Academy of Sciences, Budapest, Hungary;
[2)] Institute of Nuclear Research, Hungarian Academy of Sciences, Debrecen, Hungary;
[3)] Hungarian National Museum, Budapest, Hungary;

Bükk culture is one of the 'industrial' prehistoric cultures in the Carpathian Basin (cca. 5200-5000/4900 B.C.). It is famous for its thin-walled fine pottery decorated with white-yellow-red incrustation. Bükk pottery is claimed to be traded much beyond the limits of the tribal quarters. To understand its exchange pattern the easily recognizable decoration was investigated in details. It is important to know if there is a unity of the used paste in the Bükk culture or not.

The potential paste materials for the white incrustations could be bone, calcareous material or white clay. We applied different techniques to most effectively determine the mineralogical and chemical composition of these some tens of micrometers thick cover of paste.

Phase analyses evidenced the presence of quartz, feldspar and layered silicate phase (in some samples crystalline kaolinite could be detected, while in most of the cases rather an amorphous phase (disordered metakaolinite?) could be presumed). As colourant of the yellow to red decorations goethite and hematite was additionally identified. The incrustations contained O, Si, Fe, Al, K and Ca as major chemical components which are similar to the silicate-based composition of the ceramic bodies. The enrichment in P or C could not be proved.

These results indicate that most of the incrustations were probably made from levigated kaolinitic clay. No bone grit or calcite was used for preparing the white decoration. The combination of the micro techniques provided an effective methodology for composition and phase investigation on incrustations. The obtained results can contribute in creating the 'fingerprint' of the Bükk pottery.

Financial support by the DAAD-MÖB collaboration and the EU FP7 CHARISMA (Grant Agreement n.228330) is acknowledged.

Analysis of Byzantine fine Sgraffito ware, Incised ware and Champlevé ware from Anaia, Turkey

Meral Budak Ünaler[1)], Sedat Akkurt[1)], Lale Doger[2)]

[1)] Mechanical Engineering Department, Izmir Yüksek Teknoloji Enstitüsü, Izmir, Turkey;
[2)] Ege Üniversitesi, Izmir, Turkey;

Throughout the Byzantine history, 12th century Komnenian Period is the golden age for glazed ceramics. The Anaia excavations in Kusadasi, Turkey have a variety of finds that date back to 12th century. These finds which are similar to Kastellorizo Shipwreck, Alonnesos Shipwreck, Corinthos finds, were specified among themselves as a result of outer surface properties. In this study, six samples with three different decorations; fine sgraffito, incised and champlevé were investigated. Samples were grouped according to the outer surface applications and body identifications were made by naked eye. Furthermore main groups were classified in subgroups according to the small differences in appearance as determined by outer surface applications of samples. Relationships between main groups and subgroups were investigated. Samples were characterized by XRD, XRF, SEM-EDX and FTIR methods. Data obtained from these analyses were used in cluster analysis, for determination of relativity of these groups and their relation to the other groups that come from the Anaia excavation.

Technology, use and volcanological relevance of the Early Bronze Age pottery from Afragola Village (Naples)

Giacomo Eramo[1)], Angela Gargallo[1)], Elena Zanella[2)], Luca Nodari[3)], Umberto Russo[3)], Jim Bishop[4)], Roberto Sulpizio[1)], Mauro Di Vito[5)]

[1)] Università degli Studi di Bari "A. Moro", Bari, Italy;
[2)] Università degli Studi di Torino, Torino, Italy;
[3)] Università di Padova, Padova, Italy;
[4)] CAL srl, Brescia, Italy;
[5)] Istituto Nazionale di Geofisica e Vulcanologia, Napoli, Italy;

Rescue archaeological excavations brought to light the remains of a Bronze Age village close to the town of Afragola (Naples, Italy), partially destroyed and buried by pyroclastic density currents (PDCs) of the Pomici di Avellino eruption (Somma-Vesuvius, 3.8 ka BP). A total of 40 potsherds belonging to Palma Campania facies underwent petrographical, mineralogical, chemical and TRM analysis. In addition, a selection of 8 samples with strong differences in TRM was analysed with Mössbauer spectroscopy. The results show that all the pottery samples were made using a fine non-calcareous clay tempered with grog. The low sintering of the ceramic body (600 – 800°C) in variable redox conditions produced nano-phases of iron oxides which account for their heterogeneous magnetic behaviour. TRM analysis helped to distinguish between cooking pottery and storage pottery through the type of magnetisation recorded by potsherds and to estimate the deposition temperature of PDCs which invaded the village (260-340°C).

The result indicate that care should be exercised in the use of pottery to infer the deposition temperature of PDCs by TRM analysis, since its magnetic behaviour is not only determined by the raw materials, but also by their processing and firing. Moreover, the original function of the pottery vessels may complicate the thermal history of the samples and lead to a misleading interpretation of the data.

Siliceous slag in the Lapus Bronze Age funerary site (NW Romania): Overburned ceramic vessels?

Corina Ionescu[1)], Volker Hoeck[2)], Carola Metzner-Nebelsick[3)], Lous D. Nebelsick[4)], Carol Kacsó[5)]

[1)] Babes-Bolyai University, Cluj-Napoca, Romania;
[2)] Paris Lodron University, Salzburg, Austria;
[3)] Ludwig Maximilan University, München, Germany;
[4)] Cardinal Stefan Wyszynski University, Warsaw, Poland;
[5)] County Museum Maramures, Baia Mare, Romania;

The Bronze Age necropolis and cult area of Lăpuş (13^{th} -12^{th} century BC) is situated at the Eastern Carpathians foothills (NW Romania). The burial mounds as well as a multi-phased cult building, the latter currently being under investigation, contain large amounts of intentionally destroyed ceramic vessels which are interpreted as remnants of funerary celebrations and complex sacrifices. Scattered cm-sized dark-gray slag pieces were found as well. They have a mammillary smooth surface and high porosity. The polarized light microscopy reveals a transparent to translucent light yellow to brown glassy mass, full with various-sized gas bubbles. The BSEI and the EMPA show a glass containing partly melted quartz and feldspar, rare zircon, ilmenite and Ti-oxides. Small grains of Fe-phosphate and spinels(?) were also identified.

The bulk chemistry points to a siliceous composition, with 70.84-77.88 wt.% SiO_2 , 11.21-14.4 wt.% Al_2O_3, 3.84-2.52 wt.% Fe_2O_3, 0.78-1.66 wt.% MgO, 0.37-2.8 wt.% CaO, 0.9-1.36 wt.% Na_2O, 2.18-3.59 wt.% K_2O, 0.89-1.19 wt.% TiO_2, 0.09-0.14 wt.% MnO and 0.23-0.39 wt.% P_2O_5. The chemical data are well comparable with the average chemistry obtained from various ceramic shards found at the same archaeological level. Slag formed most likely as result of overburning ceramic vessels probably containing ritual offerings.

Acknoledgements. The study was supported by DFG Program granted to CM-N and ID-2241/2008 (CNCSIS/UEFISCDI/) granted to C.I..

Slag-tempered ceramics from the Lapus Bronze Age funerary site (NW Romania)

Volker Hoeck[1)], Corina Ionescu[2)], Carola Metzner-Nebelsick[3)], Lous D. Nebelsick[4)], Carol Kacsó[5)]

[1)] Paris Lodron University, Salzburg, Austria;
[2)] Babes-Bolyai University, Cluj-Napoca, Romania;
[3)] Ludwig Maximilan University, München, Germany;
[4)] Cardinal Stefan Wyszynski University, Warsaw, Poland;
[5)] County Museum Maramures, Baia Mare, Romania;

The Bronze Age (13th -12th century BC) necropolis and cult area from L ă puş is situated in NW Romania. Large amounts of intentionally destroyed ceramic vessels during ancient funerary celebrations, as well as scattered cm-sized slag pieces were found in a multi-phased cult building in the center of the necropolis.

The creamy, red, grey or black ceramic shards are thick-walled and have a course to semifine fabric. They often display signs of (over)burning, such as cracked black surface, partial melting, and deformed shape. Some shards contain small inclusions with a highly porous glassy body, similar to the slag. The BSEIs show transitional to sharp borders between these inclusions and the host-ceramic body. The EMPA values for major elements in the glassy parts of the slag inclusions are in the same range as those in the scattered slag pieces but differ from the values measured in the host ceramic groundmass (matrix). In terms of mineralogy, quartz, K-feldspar and albite predominate as clasts in the ceramics. Plagioclases and rock fragments occur as well. By contrast, the slag inclusions and the scattered slag pieces contain mostly quartz and plagioclase.

The similarity between the composition and fabric of the slag inclusions in ceramics and that of the scattered slag pieces points to the use of the latter as tempering material. The vessels were probably produced on site, in the frame of ritual activity.

The study was supported by DFG Program granted to CM-N and ID-2241 (UEFISCSU/CNCSIS) project granted to C.I.

Ceramic distribution, migration and interaction among huntergatherers in Late Prehistoric (1300-200 YBP) San Diego County, California

Patrick Quinn[1)], Margie Burton[2)], Rhiannon Byrne-Bowles[3)]

[1)] University College London, Institute of Archaeology, London, United Kingdom;
[2)] San Diego Archaeological Center, Escondido, USA;
[3)] University of Sheffield, Department of Archaeology, Sheffield, United Kingdom;

Building on discovery of important cultural information discernible at a microscopic level within surface scatters of Late Prehistoric plainware sherds from eastern San Diego County, California, we have examined the composition of ceramics from a large stratified and dated seasonal habitation site. The aim was to better understand migration and interaction patterns of indigenous groups of the region.

We selected 115 pottery samples from different levels within three separate excavation units at the site of Mine Wash (CA-SDI-813) in central Anza-Borrego Desert State Park. The composition of these small, undecorated sherds was characterised by a combination of thin section petrography and pXRF analysis. This was compared to an extensive petrographic and geochemical database of ceramics and raw materials from San Diego County.

Our analysis reveals a compositionally diverse assemblage that contains material from several non-local sources in the Colorado Desert to the east and the nearby Peninsular Range mountains to the west. The movement of pottery to Mine Wash is likely to reflect seasonal migration between different landscape zones along known trails, as well as possible longer-term movement related to environmental change. Compositional variation among the ceramics of the three excavation units may be interpreted as the existence of function-specific areas at Mine Wash or perhaps the activities of different social groups using the site around the same time.

Highland fine pottery of the Middle Neolithic Bükk culture (NE-Hungary): To fingerprint or not to fingerprint?

Veronika Szilagyi[1)], P. Csengeri, J. Mihály, V. Leno, Gy. Szakmány, D. Schöckle, H. Taubald, K. Biró, M. Tóth, J. Zöldföldi

[1)] Hungarian Academy of Sciences, Budapest, Hungary

To characterize the high quality fine ware of the Middle Neolithic Bükk culture (cca. 5200-5000/4900 B.C.) more than 200 pot sherds (fine and coarse ceramics) from 10 archaeological sites in Hungary were investigated by petrographic (PM), mineralogical (XRD) and geochemical (XRF) methods. Our fundamental aim was to understand the main technological choices (raw material selection, preparation, decoration, firing) and the provenance of this thin -walled (1-5 mm) minutely decorated (with incised geometric motifs infilled with white-yellow-red paste) pottery type. The appearance of Bükk fine ware in the core area of the culture (highland territories of NE-Hungary and SE-Slovakia) is so unified that its production in certain workshops from certain raw materials could be possible. To answer this standard question of provenance, Bükk culture localities in different topographic positions and geological regions (Palaeozoic metamorphic, Mesozoic carbonatic, Tertiary volcanic units) were selected and compared their fine to coarse ceramic material with the local fine-grained soils-sediments as potential raw materials.

Looking for fingerprinting characteristics, it turned out that Bükk fine ware was made with well-defined paste preparation requirements, relatively unified firing conditions and slightly variable decorating inlay materials. Based on the selected finds, no site-specific utilization of raw materials can be proved. Moreover, it became clear that more types of raw materials (fat-loan-micaceous clays) and sources (river sediments of regional characteristics and locally accessible sediments) were applied. It may indicate intensive connections between Bükk settlements even in longer distances.

Holocene pottery characteriasation from the Takarkori Rockshelter (Libyan Sahara, 9000-4000 BP)

Italo M. Muntoni[1)], Giacomo Eramo[2)], Andrea Zerboni[3)], Anna Aprile[2)], Rocco Laviano[2)], Lucia Cavorsi[4)], Savino di Lernia[4)]

[1)] Centro Operativo per l'Archeologia della Daunia, Foggia, Italy;
[2)] Università degli Studi Aldo Moro, Bari, Italy;
[3)] Dipartimento di Scienze della Terra A. Desio, Università degli Studi di Milano, Milano, Italy;
[4)] Sapienza Università di Roma, Roma, Italy;

The present work shows the results of a programme of characterisation analyses carried out on 69 potsherds sampled from different stratigraphic contexts excavated in the Takarkori rock-shelter (Tadrart Acacus Mts, SW Libya). A systematic programme of excavations was carried out by 'Sapienza' University of Rome, revealing a stratigraphic sequence covering large parts of the local Holocene cultural sequence (from 9000 to 4000 uncal years BP), from the Late Acacus hunter-gatherers (Mesolithic) to the Early, Middle and Late Pastoral (Neolithic) herders.

The Tadrart Acacus Mts. are composed of Palaeozoic sedimentary rocks (sandstone and shale) while the intrusive formation of the Tassili massif outcrops at ca. 50 Km south-westward the site. Twenty-six samples of sediments from different Pleistocene to Holocene formations were collected: they consist of fluvial sandy and silty deposits and loamy-clay sediments, deposited in lacustrine to marsh environments during wet phases. Other samples consist of sandy sediments, collected from sand sheets and dunes, which deposition occurred under arid environmental conditions.

Petrological (OM), mineralogical (PXRD), and chemical (XRF) characterizations revealed three fabrics with different prevailing clastic constituents. The Q and QC fabrics display a common petrofacies, with monocrystalline quartz as non-plastic inclusions and carbonaceous matter: they mirror the local Palaeozoic quartzarenitic bedrock of the Tadrart Acacus Mts. A third fabric (QF) is characterised by angular or sub-angular grains of quartz, potassium and plagioclase feldspars, and muscovite. QF fabric probably derived from the erosion of the non-local granite core of the Tassili massif.

The archaeometric results will be discussed with reference to regional environmental changes, local cultural dynamics, settlement systems, and mobility strategies.

Early-medieval pottery from Nikitsch (Burgenland) - An archaeometric approach

Angelika Kern[1)], Cornelius Tschegg[1)], Susanne Gier[2)], Theodoros Ntaflos[1)]

[1)] Department of Lithospheric Research, University of Vienna, Vienna, Austria;
[2)] Department for Geodynamics and Sedimentology, University of Vienna, Vienna, Austria;

Motivated by a study of Lombard settlements in Burgenland, shards from Nikitsch were analyzed in order to reveal raw material origin and manufacturing technology. To provide a basis of reference, six shards from a time period of roughly 6500 years were analyzed of which three are dated to be Lombard and three are Prehistoric, ranging from Neolithic to the Iron Ages.

Petrography, x-ray diffraction and electron-probe microanalysis were applied. The mineralogical composition of all analyzed samples is virtually identical, the specific makeup is too common to allow a definite pinpointing of a single clay pit. However, sediment deposits that could be potential for the raw material preparation of these shards are present in the area and the fact that the shards span several thousands of years still suggests the local origin of the material.

In terms of manufacturing technology it can be said that the quality of the used materials and the methods of raw-material preparation tended to improve with time. Intentional tempering also changed over time: The analyzed Prehistoric pottery contains temper material like grog and rock fragments. Lombard shards tended to be finer in grain size but without temper material.

It was not possible to discover typical Lombard manufacturing techniques or to prove that the raw material provenance is in the vicinity of Nikitsch, but this work presents a good basis for further research in Burgenland.

Compositional analysis of Iron Age ceramics from Tell el-Far'ah South, Israel: An investigation of provenance and trade

Lisa Peloschek

University of Vienna, Vienna, Austria;

During the course of excavations conducted by Sir Flinders Petrie at Tell el-Far'ah South, in the Northern Negev during 1928 and 1929, the remains of a Late Bronze Age (c. 1200 BC) building structure, interpreted as the residency of an Egyptian governor, were excavated. The present study examines ceramics from the overlying Iron Age II (10^{th} to 6^{th} c. BC) occupation horizons. So far, the character of these deposits and the associated Iron Age II society has remained ambiguous.

By means of an integrated program of typological and compositional characterization we are examining the provenance and technology of the Iron Age II vessels from Tell el-Far'ah South. We have selected 30 sherds with different macroscopic fabrics and shapes. These are being analysed by a combination of thin-section petrography, X-Ray Fluorescence and Scanning Electron Microscopy.

Our analysis aims to identify the origins of ceramics consumed at Tell el-Far'ah South, specifically whether material derived from local or regional resources, or if the excellent position of the site at the Egyptian border, not far from the coast sea resulted in supra-regional trade of specific pottery types. Our results will contribute to the understanding of regional or foreign trade relationships of the Iron Age II-society at Tell el-Far'ah and could emphasise the significance of the site in a period of change.

Cathodoluminescence (CL) of quartz as a method for archaeological ceramic provenance

Alice Hunt

UCL Institute of Archaeology, London, United Kingdom;

Quartz is ubiquitous on the earth's crust and chemically homogenous, therefore quartz is not typically used for the geochemical and petrographic provenance of archaeological ceramics. However, quartz minerals contain subtle diversity in their structure and chemical impurities related to formation processes and history which enable the provenance of detrital sediments. These structural and chemical defects of quartz are detected using cathodoluminescnence (CL) spectroscopy and have the potential to facilitate provenance of highly levigated and/or quartz rich ceramic fabrics and may even be used to determine the origin of quartz tempers.

CL uses lattice structure defects alongside chemical impurities to 'fingerprint' quartz origin. Although quartz is chemically stable, its lattice is vulnerable to low temperature metamorphism at 573°C, the α-β quartz transition. For quartz CL to be used for provenance of archaeological ceramics, it is necessary to determine experimentally whether this metamorphism interferes with the diagnostic CL fingerprint of quartz.

This paper explains the theory of quartz CL provenance, evaluates the successful results of the 'firing' experiment, and explores the use of CL quartz provenance using an archaeological case study of highly levigated ceramics.

Comparison between Messapian style Matt-Painted pottery from the "Timpone della Motta" archaeological site (Sibaritide Area, Calabria) and clayey materials and ceramic products from Apulia - Southern Italy

Eliana Andaloro[1)], Anna Maria De Francesco[1)], Italo Maria Muntoni[2)], Rocco Laviano[3)], Jan Kindberg Jacobson[4)]

[1)] Università della Calabria, Rende (CS), Italy;
[2)] Centro Operativo per l'Archeologia della Daunia, Foggia, Italy;
[3)] Università degli Studi di Bari 'Aldo Moro', Bari, Italy;
[4)] Groningen Institute of Archaeology, Groningen, Netherlands;

The Matt-Painted pottery was widely produced in Southern Italy during the Early Iron Age. The thousands of fragments from the sanctuary on the Timpone della Motta show that two predominant styles were present in the Sibaritide: “Undulating Band Style” and the “Fringe Style” based on their many decorative elements. Recent research has, however, documented a notably different group of Matt-Painted pottery in this site. The closest typological and stylistic ceramics are found among the Matt-Painted pottery productions in the Salento region (Southern Apulia).

The compositional characteristics of the “Salentine” matt-painted pottery are different respect to the other styles documented at Timpone della Motta and to the analyzed clayey materials from the area. Because of this evidences, a comparison between the Messapian matt-painted pottery from the Timpone della Motta and clayey raw materials and ceramic productions from the Apulia were carried out. The overall petrographic, mineralogical and chemical compositions of the analyzed matt-painted ware is more or less comparable with that of the marine Plio-Pleistocene clays of the Bradanic cycle, which extensively crop out in different areas of Apulia, and with other Apulian matt-painted productions. The observed differences and similarity will be then discussed and lead to hypotheses on the source area of raw materials and their processing.

Regional ceramic production at Düzen Tepe and the Lake Burdur area (Southwest Turkey) during the Classical and Hellenistic period

Dennis Braekmans[1)], Patrick Degryse[1)], Jeroen Poblome[1)], Bert Neyt[1)], Marc Waelkens[1)]

[1)] K.U.Leuven, Heverlee, Belgium;

Central in the debate is the site of Düzen Tepe, located 1.8km South from Sagalassos, excavated since 2006. This study specifically focuses on the ceramics from the Classical and Hellenistic periods (5th-2nd century BC), preceding the mass production of Roman imperial ceramics at Sagalassos.

The ceramics of this site are compared to pottery of Archaic, Classical and Hellenistic sites in the later territory of Sagalassos (Düver, Belören, Seydiköy, Hisar, Aykırıkça, Suludere, Gavur Evi, Bereket, Kökez, Kepez Kalesi, Taşkapı Kale and Körustan), the survey remains from smaller sites within the Ağlasun Valley itself and finally with the Hellenistic ceramics of neighbouring Sagalassos.

Questions remain towards the understanding of the variability in these wares, as macroscopic classification from a fabric point of view proves to be highly erratic for a reliable mapping of these ceramics. Also, the provenance question needs addressing, collecting information on the possible common origin of the pottery from different sites and/or periods. Related to the question of local production is the circulation of wares and the transfer of technological solutions.

In order to create both a typo-chronological and archaeometric framework, a set of 361 archaeological samples was collected. The analytical procedure followed included optical microscopy and chemical analysis (ICP-MS, EMPA). Major and trace element diagrams and NASC-normalized multi-element diagrams were edited in order to determine the variability within the ceramics. This study reflects the ability to establish whether the main types of pottery appearing in the Archaic, Classical and Hellenistic period in the Sagalassos area are locally produced or imported. These results can add to the discussion on changes in craft activities, and by extension possible cultural changes in Sagalassos, Pisidia and the area of Southwest Turkey in general.

Nagytétény: the grave of a prehistoric cosmopolitan

Katalin T. Biró[1)], Veronika Szilágyi[2)], Zsolt Kasztovsky[2)], Zsuzsanna Virág[3)]

[1)] Hungarian National Museum, Budapest, Hungary;
[2)] Institute of Isotopes, HAS, Budapest, Hungary;
[3)] Budapest Historical Museum, Budapest, Hungary;

In the 1930-ies, Sándor Gallus excavated a special grave in the outskirts of Budapest, district known as Nagytétény. The grave immediately got into the centre of scientific interest as remains of four complete vessels were found here, all of them belonging to different coeval Neolithic cultures of the Carpathian Basin: Bükk Culture, Transdanubian Linear Pottery Culture, Zselíz Culture and Vinca Culture according to the first communications. The special find assemblage was recently presented on a temporary exhibition at the Hungarian National Museum consecrated to prehistoric trade and communication roads. Recently, the authors were involved in several studies on pottery archaeometry of the same period (=Middle Neolithic) and, partly, the same region (Budapest environs, material of Budapest Historical Museum). This background information allowed us to try the geochemical fingerprinting of this famous assemblage as part of the regional potter's tradition and potential long distance pottery transport. Prompt Gamma Activation Analysis was used to study major- and some characteristic accessory elements composition. Furthermore, data were compared with the relevant content of the CeraMIS database.

Provenance studies of archaeological artifacts by internal monostandard Neutron Activation Analysis

Kishore Babu Dasari[1)], R. Acharya[2)], N. Lakshmana Das[1),] A.V.R. Reddy[3)]

[1)] GITAM University, Visakhapatnam, India;
[2)] Radiochemistry Division, India;
[3)] Bhabha Atomic Research Centre, Mumbai, India;

Provenance studies of archaeological artifacts like potteries, bricks, tiles, coins and paintings are being carried out to unravel past human activities, production method, chemical composition and source/origin finding. To get the idea on whether samples under study are from same or different origin, knowledge on chemical composition of artifacts is very essential. Among various analytical methods, neutron activation analysis (NAA) using reactor neutrons is found to be very powerful technique for determination concentrations elements from major to trace levels due to its advantageous properties like high sensitivity, low detection limits, negligible matrix effect and often non-destructive in nature. Use of internal monostandard NAA (IM-NAA) method in conjunction with insitu detection efficiency is capable of analyzing samples of non-standard geometry and gives elemental concentration ratios with respect to the monostandard. This method is unique for provenance study, since elemental concentration ratios are enough for grouping the artifacts and thus it does not require the knowledge on concentration of standard.

In the present work, ancient potteries and bricks, obtained from Buddhist (5^{th} century B.C to 4^{th} century A.D.) sites of Andhra Pradesh, India, along with freshly prepared potteries were analyzed by IM-INAA for the provenance study. Both small (100 mg) and large (5-50 g) size samples were neutron irradiated in CIRUS reactor and AHWR critical facility (CF) for 7 h and 4 h respectively. Radioactivity assay was carried out using a high resolution gamma ray spectrometer consisting of a 40% relative efficiency HPGe detector coupled to 8k MCA. Concentration ratios of Na, K, Zn, Cr, As, Ga, Fe, Cs, Rb, Co, La, Ce, Eu, Nd, Ta, Sm, Yb, Hf and Th with respect to Sc were determined. Preliminary grouping of artifacts was done by La/Ce values and the confirmation of the same was carried out by statistical cluster analysis using some key elements. The results of grouping were compared with the collection location and the deviation if any were discussed in terms varying source than expected. Freshly prepared potteries and bricks were found quite different than ancient artifacts, indicating the promise of the method for provenance study.

Archaeometric study of the Neolithic pottery from the "Le Grottelline" site (Spinazzola, Italy)

Bruno Fabbri

CNR-Istituto di Scienza e Tecnologia dei Materiali Ceramici, Faenza, Italy;

The "Le Grottelline" site in southern Italy dates back to the ancient Neolithic Age. Four ceramic classes were recognized: coarse and semi-depurated (with different ize of the inclusions), and depurated and figulina (with different macro-porosity). Coarse and semi-depurated ceramics together represent about 80% of the recovered pottery. The archaeometric study was carried out by means of optical microscopy in thin section, WDS-XRF, and XRD. The results individuated two ceramic classes: coarse pottery (with large silicate inclusions in a fine clay matrix) and fine pottery (10-13% wt of calcium oxide), and three isolated samples. The crystalline phases allowed to hypothesize a firing temperature <800°C for coarse pottery, and 800 to 900°C for fine pottery. Good similarities were registered with pottery of near Neolithic sites, considered as local production, allowing to consider as local also the main part of the "Le Grottelline" pottery. In addition, the raw materials show geological features typical of the area that includes argillaceous deposits with frequent fossil-rich levels. The variations in the micro-structural and chemical characteristics could be attributed to different collecting areas and/or to casual changes in ceramic processing.

Carbon isotope analysis on Celtic graphite-tempered archaeological ceramics from the South Transdanubian region (Hungary) and on potential graphitic source rocks from the territory of Bohemian Massif

Izabella Havancsák[1)], József Fekete[1)], Bernadett Bajnóczi[1)]

[1)] HAS-Geochemical Research Institute, Budapest, Hungary;

The Celtic graphitic ceramics, tempered with graphitic rock, are well known from most part of the Central European Celtic world. Celtic graphitic ceramics can be found in a wide geographical area, not only around the graphitic rock sources. Former results, based on mineralogical and petrographic analyses carried out on graphitic ceramics from Hungary, suggest that the graphitic temper (medium- to high-grade metamorphic gneiss) is most probably originated from the territory of Bohemian Massif.

This study presents the first example of carbon isotope analysis used in the archaeometric research of graphite-tempered ceramics. Graphite separated from Celtic graphitic ceramics from Szűr, Szajk and Dunaszentgyörgy archaeological sites (South Transdanubian region of Hungary) and selected graphitic gneiss samples from the potential source area were analysed.

Variation in δ13C values of graphite in each sampling site is attributed to the characteristics of graphitic rock used for tempering. The observed variability suggest that the graphitic raw material was not homogenous in its carbon isotope composition. Kinetic fractionation effect and isotope exchange between graphite and carbonate in the pottery can be neglected. Based on the obtained $\delta^{13}C$ values, the graphite temper is supposed to be syngenetic carbon material (i.e. formed by the metamorphism).

The applicability of carbon isotope analysis of graphite for determination of provenance of graphite temper in archaeological ceramics will be evaluated.

The Frankfurt University's Southeast Anatolia project: Archaeometrical investigations on Early Bronze Age pottery

Mustafa Kibaroglu[1)], Christian Falb[1)]

[1)] Institute for Archaeological Sciences, Goethe-University, Frankfurt am Main, Germany;

In the first quarter of the 3rd millennium BC a cultural group settled in Southeast Anatolia and Northeastern Syria of which the most prominent attribute is a very characteristic ceramic ware, the so called northmesopotamian Metallic Ware, dated to the Early Bronze Age II and IV A (c. 2800–2300 BC). Because of its unique cultural significance and it's characteristic technological features it has been the subject of various archaeological and archaeometrical studies carried out during last 35 years. Previous archaeometric studies have proved that almost all known Metallic Ware was produced from special non-calcareous clays which showed a very different composition from clays of the alluvial region of the syrian Jezira and Upper Mesopotamia in general. Though numerous archaeometric studies have been carried out hitherto, the provenance of the non-calcareous clay source is still unknown.

The Southeastern Anatolia Project is aimed at making contributions to a better understanding of the history of the regions to the north and the south of the modern turkish-syrian border, which in Early Bronze Age must have formed a cultural unity with a certain centralized organization. In addition to archaeological investigations, also chemical and petrographic investigations are carried out on pottery samples.

This paper is a preliminary report of the first results of major and trace elements analyses carried out on north´mesopotamian Metallic Ware collected from several sites throughout Southeastern Anatolia, and also on clay samples from the Tigris Valley, the Karacadağ and the Pütürge region in southeast of Malatya. In addition to the traditional way of the archaeometrical investigation concerning the provenance of ancient ceramics, the chemical data of the non-calcareous northmesopotamian Metallic Ware have been used to reconstruct the possible parent rock type of the raw clay in a similar way as it is applied in sediment geochemistry.

The results, so far, point out that the raw clays of the non-calcareous Metallic Ware derived from metamorphic rocks such as gneiss and/or slate and may be situated in the Pütürge region within the so called Pütürge Massif, where such metamorphic rocks are largely exposed.

Trojan Pithoi: A petrographic approach to provenance and production technique of Middle Bronze Age storage vessels from Troy

Mustafa Kibaroglu[1)], Diane Thumm-Doğrayan[2)]

[1)] Institute for Archaeological Sciences, Goethe-University, Frankfurt am Main, Germany;
[2)] Institute for Pre- and Protohistory and Medieval Archaeology, Eberhard-Karls University of Tübingen, Tübingen, Germany;

Application of scientific techniques to explore questions related to archaeological research in Troy was always an important issue and applied widely to various archaeological materials. Various pottery types from different periods of Troy were THE subject of several studies using methods of petrography, geochemistry and radiogenic isotopes. However, the large storage vessels, called pithoi, excavated in Troy have received less attention in archaeoemetric studies. In general, archaeometric investigations of such large storage vessels have been limited. Such large vessels are usually assumed to have been produced locally because of the difficulty of their transport.

In this paper we report the results of petrographic analysis of Late Bronze Age (Troia VII, ca. 1300-1000 BC.) large storage vessels, pithoi, excavated in Troy, in order to characterize the clay groups, with a view to determining provenance and production technique. The results reveal some valuable information about the production tradition of large storage vessel in Troy during the Late Bronze Age. Obviously the potters used different clay sources, partly derived from very different parent rocks, for example in-situ clay formation from gneiss and peridotite. A tendency in choice of the raw clay that can be observed may be related to the production technique of such large storage vessels. The clay sources selected for pithoi can be assigned to different geological areas, located between 10 to 20 km south of Troy, in the Ezine region and surrounding areas.

From over the sea or from the island? Provenance study of ceramics from Vanuatu

Mathieu Leclerc

Australian National University, Canberra, Australia;

This project is oriented toward reconstructing distribution and exchange patterns, as well as population movement, based on exotic ceramic distribution throughout the archipelago of Vanuatu. Because of Vanuatu's particular geographical location, it represents a crucial place for understanding population movements in the Pacific and accordingly, it is believed that Vanuatu was a major stepping stone during the initial human colonization of this part of the world about 3000 years ago. More than 20 Lapita sites, where pottery showing similar motifs as on other Lapita sites located elsewhere in Remote Oceania, have been found in Vanuatu. Among these sites is a uniquely large Lapita cemetery with pottery in direct association with burials.

The following post-Lapita archaeological record shows a greater variability of pot shapes and motifs as regional diversification is observed all across the archipelago. A fairly complete sequence for Central Vanuatu in particular has been established and covers the whole span of ceramic production from 3200 BP to 1200 BP.

The aim of this project is to undertake a detailed geochemical study of pottery and soil samples using several analytical techniques providing complementary information (optical and petrographic microscopy, XRD, LA-ICP-MS and lead isotopic ratios) in order to identify pottery manufacture locations and thus contribute to the understanding of modes of production and to study transformation of these processes through time.

Did Cartier really test gold in Canada? Crucibles analysis from the first French colony in America

Yves Monette

Canadian Museum of Civilization, Gatineau, Qc, Canada;

During the last five years, extended archaeological excavations were carried on the Charlesbourg-Royal colony established near Québec City, Canada. This two year occupation (1541-43) has left an important quantity of artifacts out if which the abundance of refractory ceramics attests precious metal exploration.

Metallurgical residue analysis was carried out in the aim of documenting the nature of the ore material tested. In parallel, we also conducted paste compositional analysis to verify if the crucibles were the products of a unique center. We also searched for their provenance since we are facing a particular case for precious metal exploration in Early America: none of the crucibles come from the well known Hesse centers as it is normally the case for this period, no matter if we look at early colonial sites in the Spanish, Portuguese or English colonies.

White ware studied from an archaeometric point of view

Bonnie Nilhamn

Vrije universiteit, Amsterdam, Netherlands;

White Ware, or vaiselle blanche, are vessels made out of gypsum or limestone plaster. These containers were exceptionally common in the Early Pottery Neolithic occupation levels at Tell Sabi Abyad, north Syria, between ca. 6900 and 6200 cal. BC.

This plaster ware belongs, next to floor and wall plaster to the earliest plaster features of the Near East. What makes white ware so special is that we are dealing with another kind of containers than the “normal clay pottery” in a time ceramics itself is in a developing phase. Previous white ware research has been focusing on typology and the spatial distribution. This study focuses instead on the chemical composition and its physical properties in order to answer questions around why the ancient inhabitants used different kind of raw materials when making containers. The bias that people prefer to use material from the vicinity is here a dangerous assumption as the result has shown that the main raw material for the plaster is gypsum and not the easier attainable local limestone.

This poster presents the results of analytical work employing thin section petrography and XRF, aimed at understanding the nature and properties of the ware. Further, this poster wants to give the audience an introduction to the otherwise less known white ware and its role within the study of early Near Eastern society.

Results of preliminary petrographic studies of Langobard age ceramics from Balatonlelle and Szólád (Hungary)

Katalin Pánczél-Bajnok[1)], György Szakmány[2)], Péter Pánczél[2)], Bernadett Bajnóczi[3)], Uta von Freeden[4)], Péter Skriba[1)], Tivadar Vida[1)]

[1)] Institute of Archaeological Sciences, Eötvös Loránd University, Budapest, Hungary;
[2)] Institute of Geography and Earth Sciences, Eötvös Loránd University, Budapest, Hungary;
[3)] Institute for Geochemical Research, Hungarian Academy of Science, Budapest, Hungary;
[4)] Römisch Germanische Kommission des Deutschen Archäologischen Instituts, Frankfurt a. M., Germany;

During our work we carried out petrographic studies on ceramics of two archaeological sites, the settlement from Balatonlelle, Felső Gamász and the cemetery from Szólád from the Langobard age near the southern part of Lake Balaton.

The Langobard people were staying in Pannonia province around 526-568. In Balatonlelle mostly hand-built household ceramics, sweb pots (Kumpf) and wheel-thrown, late antique featured vessels were excavated, and occasionally some biconic cup-vessels (Schalengefäß) and a pear-shaped vessel were found as well. In Szólád biconic cup-vessels and sweb cups were also dominant, besides only a Thuringian cup and a wheel-thrown jar with a pouring lip were found.

Generally coarse-grained rock fragments and their mineral constituents are present as non-plastic components in the ceramics of Balatonlelle. Among them basalt and sandstone can be found near the sites, unlike marble and andesite fragments. The fine-grained ceramics without any non-plastic components are rare. Dominantly carbonate and quartz were the non-plastic components of the ceramics from Szólád, but there were some ceramics with sandstone and marble fragments. The jar from Szólád does not contain any non-plastic components either. The cathodoluminescence microscopy studies showed different luminescence colours for the marble fragments of Balatonlelle and Szólád samples. Moreover further study is needed to decide whether the samples from Balatonlelle contain different types of marble fragments.

Mineralogical composition of ceramics from Garvao iron age votive deposit (Portugal)

Lucia Rosado[1)], António Candeias[1)], Patricia Moita[1)], Deolinda Tavares[2)], Françoise Mayet[3)], Maria Lopes[3)], Rafael Alfenim[2)], José Mirão[1)]

[1)] University of Évora, HERCULES Laboratory, Évora, Portugal;
[2)] Alentejo Regional Directorate of Culture, Évora, Portugal;
[3)] University of Coimbra, CEAUCP, Coimbra, Portugal;

In 1982, a votive deposit was discovered in Garvão (SW Portugal) revealing an important Iron Age II holy site. The pottery recovered shows that during Iron Age this archeological site was a merging geostrategic point of the Iberian societies with strong influences of the Mediterranean world and the Iberia celtic influences.

Raw materials used by these communities provide essential information to understand specific historical periods, particularly concerning the relationship of the societies with surrounding environment, eventual existence of trade routes and available technology. The geological resources are particularly useful for this purpose because even processed they can figure out identifiable signatures of provenance or technology used. Moreover, their intermittent occurrence and human necessity justify the existence of trade routes.

Special emphasis will be given to the provenance of the pottery, the technological aspects and the relationship between populations and Garvão holy site. The study of geological raw materials applying and combining modern techniques of earth materials sciences and the principles of physical sciences (e.g. geology and chemistry) can provide answers and a better understanding of the Garvão importance in this area of the Iberian Peninsula. A multi-analytical methodology was setup using optical and electron microscopy, infrared spectroscopy and X-ray diffraction.

Common wares from the forum of Pompeii: Provenance and technological aspects

Roberta Scarpelli[1)], Anna Maria De Francesco[1)], Daniela Cottica[2)], Luana Toniolo[3)]

[1)] Università della Calabria, Dipartimento di Scienze della Terra, Arcavacata di Rende, Cosenza, Italy;
[2)] Università Ca' Foscari, Dipartimento di Scienze dell'Antichità e del Vicino Oriente, Venezia, Italy;
[3)] Università Ca' Foscari, Dipartimento di Scienze dell'Antichità e del Vicino Oriente, Venezia, Italy;

The preliminary results of the archaeometric study on common wares, both cooking wares and plain wares, excavated in 1980-81 at the eastern side of the Forum of Pompeii (Naples, Italy), are presented. The analysed pottery samples date from the end of the third century B.C. to 79 A .D. and allow to investigate the production change of this ceramic class over a long time-span. On the basis of the morpho-typological analysis, most of these vessels can be considered of local production, instead an extra-regional provenance is supposed for a small group. The archaeometric study aims to verify the social and political changes that from II century, but especially from the first century B.C., the Pompeii town has highlighted with the opening of new extraregional common ware trade, in the Bay of Naples.

Optical microscopy (OM), XRD and XRF analysis performed on the ceramic samples, allowed to verify the provenance of the different groups (local and extra-regional groups) and to reconstruct the technological changes over time for local vessels (firing temperature and raw material source area).

Heavy mineralogical study of Middle Iron Age painted pottery from Alisar Höyük and Kaman-Kalehöyük, Turkey: Identification of trade activity

Bong Shun Kai Willy[1)], Matsumura Kimiyoshi[2)], Omura Sachihiro[2)], Sencer Sayhan[3)], Yokoyama Kazumi[4)], Nakai Izumi[1)]

[1)] Tokyo University of Science, Tokyo, Japan;
[2)] Japanese Institute of Anatolian Archaeology, Tokyo, Japan;
[3)] Department of Geology, Gazi University, Kirsehir, Turkey;
[4)] Department of Geology, National Museum of Nature and Science, Tokyo, Japan;

During the Middle Iron Age (MIA, 850 B.C. - 740 B.C), painted pottery decorated with animals and geometrical motif can generally be found in most of archaeological sites in central Anatolia. In present work, we attempt to determine the provenance of the painted pottery that uncovered from both Kaman-Kalehöyük and Alişar Höyük archaeological site, to examine if there was any trade activity between these two sites during the MIA period. 28 sediment samples collected within a radius of 20 km from Alişar Höyük and 80 sediments samples collected within a radius of 50 km from Kaman-Kalehöyük were analyzed by using heavy mineralogical methods, including modal proportions and geochemical study of individual amphibole grains. These data could help us to trace the geological background of individual pottery samples from their find spot to their place of origin. As a sample preparation, heavy and light minerals were separated by using methylene iodide with the specific gravity of 2.82 1). Over 30,000 grains of heavy minerals in both sediment and pottery samples were identified and counted by studying their chemical composition using SEM-EDS. The chemical compositions of amphibole, abundant in most of the samples, were analyzed by using an electron-microprobe. Our results show that rich diversity of heavy mineral compositions of the sediment samples that located around both Kaman and Alisar archaeological sites is particularly useful to pinpoint the production sources of the MIA pottery with remarkable precision.

1) W.S.K. Bong, et. al., Journal of Archaeological Science, 37(9), 2010, 2165-2178.

Retrieving the pieces of the past: Magoula Visviki and its pottery assemblage

Areti Pentedeka[1)], Eva Alram[2)], Caroline Dürauer[3)]

[1)] Fitch Laboratory, British School at Athens, Athens, Greece;
[2)] Mykenische Kommission, Österreichische Akademie der Wissenschaften, Vienna, Austria;
[3)] Salzburg, Seekirchen, Austria;

Magoula Visviki (Thessaly, Greece) is a tell settlement dating to the Middle and Late Neolithic. It was excavated during World War II, and the post-excavation life of its finds was rather adventurous, reflecting the post-war historical developments of Europe 's recent past. Re-assessment of the Visviki ceramic assemblage, stored in Greece and Germany, reveals a rich pottery repertoire typical for Neolithic Thessaly. Systematic macroscopic and typological study, combined with petrographic analysis, raw material prospection and experimentation has enabled the characterisation of the local pottery production. Almost a hundred sherds were sampled and thin-sectioned, and twenty-two raw material and geological samples were collected and processed experimentally, while a large thin-section dataset from Neolithic Thessaly was used as comparative material, in order to shed light on provenance issues and give insight to the settlement's interaction networks. The integrated approach adopted yielded significant results with regard to both pottery technology and exchange, as it revealed a long-lasting local pottery tradition along with participation to various pottery exchange networks active on both the inter-regional and intra-regional level.

Fineware and beyond: production and exchange of pottery from the Mycenaean port of Kanakia, Salamis

Peter M. Day[1)], Noémi S. Müller[2)], William Gilstrap[1)], Vassilis Kilikoglou[2)], Apostolos Papadimitriou[3)], Christina Marabea[4)], G. Lolos Yannos[4)]

[1)] University of Sheffield, Sheffield, United Kingdom;
[2)] Institute of Materials Science, Attika, Greece;
[3)] 1st Ephorate of Prehistoric and Classical Antiquities, Athens, Greece;
[4)] Department of History and Archaeology, Ioannina, Greece;

Recent excavations at Kanakia on the island of Salamis have revealed a major Mycenaean harbour-side town with impressive architectural and ceramic remains chiefly of the LHIIIB period (ca. 1300-1200 BCE). Detailed study of the ceramics has revealed a varied assemblage, from fine, high-quality pottery to large scale storage jars and bathtubs.

The ceramic assemblage, grouped by detailed macroscopic study, was analysed by INAA, thin section petrography and SEM in order to reconstruct the technology of various pottery groups and, where possible, to address questions of provenance. There is clear evidence for the large scale importation of pottery to the site, from surrounding areas, primary amongst which are the volcanic cooking and kitchen wares from the island of Aegina. New developments include the large scale movement of painted wares, not just the finest vessels which have epitomised previous provenance work on Mycenaean ceramics. Comparison with a contemporary deposit from Plaka, Athens has proved invaluable in reconstructing the movement of ceramic groups.

The illumination of production and exchange patterns within the Saronic Gulf has much to add to the current debate over the social and political status of Kanakia. Moving beyond a narrow reading of the movement of prestige ceramics allows increasingly detailed comment on craft, consumption and everyday interactions in this important period.

Ceramic production and distribution in North-East of Italy: a possible trade network between the Friuli Venezia Giulia and the Veneto regions during the final Bronze Age and the beginning of the Iron Age

Marta Tenconi[1)], Lara Maritan[1)], Giovanni Leonardi[1)], Benedetta Prosdocimi[2)]

[1)] Università degli Studi di Padova, Padova, Italy;
[2)] Università degli Studi di Udine, Udine, Italy;

A particular pottery type characterized by a flaring rim and flat lip spread across the Friuli Venezia Giulia region (North-East of Italy), between the final Bronze Age and the beginning of the Iron Age. A select number of these ceramics have also been discovered in some sites of the neighboring region of Veneto. Combined petrographic and chemical analysis has been carried out on several shards coming from three sites of the Veneto region (Concordia Sagittaria, Padova, Castion d'Erbè) with the aim of distinguishing between local and imported varieties. The petrographic analysis has revealed that the local products and the suspected imported artefacts (pots with flaring rim and flat lip) are compositionally distinct. Moreover, the minero-petrographic composition of these potsherds is similar. In detail, the presence of carbonate fragments with growing and saw teeth structures, showing alternation of white and dark-brown growing laminae, indicates the use of a similar temper that may be composed of concretions or speleothems. In addition, the petrographic results have been compared with those of a small number of shards coming from the Friuli Venezia Giulia region and have revealed great similarity. This suggests that this pottery may have originated from the Friuli Venezia Giulia and been transported to the neighboring region.

Defining Corinthian cooking fabric from Late Roman Panayia field, Corinth

Heather Graybehl[1)], Marc Hammond[2)], Peter Day[3)]

[1)] University of Sheffield, Department of Archaeology, Sheffield, United Kingdom;
[2)] University of Missouri-Columbia, Columbia, Missouri, USA;

Corinthian cooking fabric (C.c.f) is the most prevalent type of ceramic fabric found in the Late Roman (4^{th}-7^{th} centuries AD) assemblages in Panayia Field, Corinth, Greece. It was employed in the manufacture of various coarseware vessels found at Corinth during the course of the Roman period. This fabric was used not only for cooking pots, but also for amphorae, basins, and table wares. In order to gain a greater understanding of ceramic technology, vessel provenance, and production and distribution of Corinthian wares in both local and pan-Mediterranean contexts, a petrographic study was conducted. This was used as a tool to clarify the raw materials used in the fabric, and, if possible its location of production and to examine its variability over time.

The petrographic analysis identified C.c.f to be a homogenous fabric type, that changed very little. Additionally, the raw materials used in the production are compatible with an origin in the area of Corinth, indicating that the vessels were produced locally. This evidence was supported by comparative fabrics published by Whitbread from the Berbati valley. Indeed, published Corinthian cooking fabrics from the 12^{th}-13^{th} centuries AD show that the manufacture of cooking vessels in the area changed very little over 1000 years. The petrographic results indicate that not only that large-scale production of coarseware vessels was taking place in Corinth, but that ceramic traditions of the workshops continued for at least nine centuries. The paper discusses results of the petrographic study, and considers their implications regarding production and distribution of coarseware fabrics in Late Roman Corinth.

Imitations or local reinterpretations? The cross cultural transmission of ceramic patterns in the Maltese Punic and Roman pottery

Alessandro Quercia

School of Archaeology and Ancient History, Leicester, United Kingdom;

Material culture, mainly the pottery, is one of the main clues to a better knowledge of the processes of cross-craft interaction and transmission between communities strongly marked by forms of cultural contact. The reception of ceramic forms, techniques and decorations from different cultural identities by local groups generated various phenomena of import and imitation, as well as creative reinterpretation and manipulation. This adoption was mostly conscious, distinctive and selective, since it reflected adaptation to local and contextual demands and imperatives.

Malta represents one of the most interesting case studies of the Antiquity because of its physical position which favoured cultural contacts, as well as social and economical interrelations with the Mediterranean world throughout time. The archaeological evidence shows how the pottery attested in Phoenician and Punic Malta derived partially from foreign patterns which were adopted and adapted to local craft traditions and consumption demands; on the contrary, the evidence of the imports whose shapes were locally imitated was scarce in Malta. This phenomenon continued in the Roman period when Italic shapes were widely reproduced in the Maltese repertoire.

In this paper, I focus on the local imitation and reworking of foreign ceramic models with particular stress on the archaeological evidence and distribution in the Maltese sites and contexts (places of cult, tombs, domestic areas), as well as on technological aspects and modes of production. Also, I will emphasise why and when this phenomenon occurred, how it affected the local material culture and which social and economical affections it generated in the Maltese world.

The combined use of petrography and petrology to investigate the Bronze Age inter- and Extra-insular pottery network exchange in the Aeolian Archipelago

Pamela Fragnoli[1)], Sara Tiziana Levi[2)], Daniele Brunelli[2)]

[1)] Modena e Ferrara,Modena, Italy;
[2)] Università degli Studi di Modena e Reggio Emilia, Italy;

259 samples from Lipari, Filicudi and Stromboli and 7 samples of Aeolian typology from Milazzo (Sicily) and Vivara (Gulf of Naples) have been analyzed with the polarizing microscope. 124 samples have been then selected to analyze the composition in major (EMPA) and trace elements (Laser Ablation ICP-MS) of the minerals forming the ceramic skeleton.

Stromboli presents a greater incidence of extra-Aeolian importations (20% vs 3,2% for Lipari and 9% for Filicudi). In Filicudi and Lipari such samples contain schistose rocks, compatible with the northeastern Sicilian lithologies, while granites, cropping out in Calabria, predominate in Stromboli. Few samples imported from volcanic effusive regions to Stromboli contain clinopyroxenes compatible with the Italian peninsular trends (positive Hf anomalies).

The samples from Lipari present constant petrographic and petrologic characteristics: presence of volcanic glass and rhyolites; pyroxenes with < CaO, > incompatible elements and accentuated negative anomalies of Europium. Few samples from Filicudi (decorated) and Stromboli (not only decorated) and the samples of Aeolian typology from Vivara (decorated) show typical Liparian characteristics.

The most samples from Filicudi and Stromboli and the samples of Aeolian typology from Milazzo (not decorated) are petrographically similar (andesites with hydrated phases). However, those from Stromboli distinguish themselves by the horneblendes composition (< K_2O, Ba, Sr, Nb, Ta and > Lu, Gd, Er, Dy), while those from Filicudi and Milazzo appear petrologically identical.

This integrated study has highlighted the existence of local productions on the three islands and differentiated inter-insular and extra-insular relationships.

Black gloss and terra sigillata from the Roman town of Cosa (1st BC - 1st AD). An approach to its provenance and technology

Marisol Madrid i Fernandez[1)], Jaume Buxeda i Garrigós[1)], M. Roca Roumens[1)]

[1)] Universitat de Barcelona, Barcelona, Spain;

Cosa is one of the first colonies established in the Italian Peninsula during the first half of the 3rd century BC in order to assert the control over the Etruscan region. Thanks to its port, the earliest Roman harbor so far known, Cosa became a great export hub for wine and garum reaching its height in the later 2nd and early 1st centuries BC. By the start of Augustan period (27 BC- 14 AD), the need for Cosa as the harbor for a great export had passed, but was still used as a local port for the import of goods required by the surrounding Imperial villas. The archaeological works undertook in the Roman town of Cosa started in the past century providing, among others, significant amounts of black gloss and terra sigillata. Thus, the aim of this article is to present the results of the archaometrical characterization conducted on black gloss and terra sigillata pottery recovered from Cosa in order to shed light on the provenance and exchange structures of this kind of ceramics on the Italian Peninsula. For this purpose, all the individuals were analyzed by means of X Ray Fluorescence (XRF) for the studies of provenance, and X Ray Diffraction (XRD) for the studies on the technology used for their production. A selection of them has further been analyzed under the Scanning Electron Microscopy (SEM) in order to complement the technological study. These results were compared with those already achieved for the same period and the same materials in the Catalan Coast, in the Iberian Peninsula, in order to deep in the role of the workshops involved in the commercialization of these products in Western Mediterranean.

Cooking pot technologies and cultural change in South East Spain in the 6th-11th centuries

Jose C. Carvajal[1)], Peter M. Day[1)]

[1)] The University of Sheffield, Sheffield, United Kingdom;

The question of continuity and change in ceramic technologies in Spain during the Visigothic and Muslim periods links cultural and technological transitions. In spite of the importance of this question, it has been hardly addressed by scholars, who have traditionally focused on typological analysis rather than on change in craft practice over time.

This paper presents a thin section petrography study of cooking pots from a range of sites of south east Spain between the 6th and the 11th centuries CE. The combined chronology of the sites includes the late Visigothic period and the rise and fall of the Umayyad caliphate of Cordoba. The object of this study is a selected part of the ceramic assemblages, which have been studied in terms of their morphology, surface modifications and evidence of forming techniques.

While this forms part of a larger investigation, the first results are enlightening when traditional analysis is combined with the current macroscopic and microscopic approaches to technological reconstruction. With only limited variability in fabrics and technologies, a pattern of change is observed. From largely independent production in different sites subjected to common circumstances and different cultural traditions, the production of these specialised vessels seems steadily more standardised as a result of increasing interaction of potters. In the final stage, potters' techniques are arranged in a more complex system of production in urban nucleated workshops.

The pottery production of the Late Medieval and Early Modern City of Barcelona. The role of petrography

Roberta Di Febo[1)], Jaume Buxeda i Garrigós[1)], Marisol Madrid i Fernandez[1)], Judit Molera[2)]

[1)] Universitat de Barcelona, Barcelona, Spain;
[2)] Universitat de Vic, Vic, Spain;

Barcelona is a well-known majolica production centre. The importance of its ceramic activity during the late medieval and early modern periods is reflected both in extensive historical documentation and also in the streets' toponyms, which even today retain the memory of this ancient activity. Ceramic production in the city of Barcelona is a particularly complex area of study because of the fact that workshops located in the same geological area, the Pla of Barcelona, share the same raw materials. This causes the production of work with a ceramic paste that is highly homogeneous at the chemical level.

It is well known that petrographic analysis, when combined with other analytical techniques and archaeological information, can successfully support provenance studies of archaeological ceramics. This incorporates assessment of production technology, treatment of raw materials, and the operation of, and qualitative differences between, different workshops in the same production area.

This contribution presents a preliminary petrographic study of ceramic variability in the city of Barcelona. Specific emphasis is placed upon the variability that determines technological and chemical changes among individuals of the same, and different, ceramic workshops. In this way, the key role of petrographic analysis in the extrapolation of theoretical patterns of majolica production in the workshops of the city of Barcelona is explored and clarified.

Istanbul ceramic workshops project. First laboratory study of a Constantinopolitan production of Byzantine ceramics

Yona Waksman

Laboratoire de Céramologie, Lyon, France;

The rescue excavations undertaken in Istanbul by the Archaeological Museums of Istanbul, in the framework of the Marmaray infrastructure project, recently unearthed the remains of one or several ceramics workshops, at least partly dated back to the late Byzantine period. This exceptional discovery provides, for the first time, the opportunity to study the manufacture of Byzantine ceramics in Constantinople / Istanbul. The "Istanbul Ceramic Workshops Project" intended to investigate these productions and to constitute, with the help of chemical analysis, a corpus of related reference data. The new reference groups could then be used for diffusion studies and to test the attribution to Contantinople of several categories of ceramics. As the capital of the Byzantine empire, the city has been considered the origin of many ceramics productions, due to relative abundance and persistance of similar fabrics in the Ottoman period (Byzantine White Ware, Hayes 1992), or to quality of execution and large scale of diffusion (e.g. Zeuxippus Ware, Megaw 1968). The new excavations provide, at last, archaeological evidence enabling to test these hypotheses and to build up knowledge on Byzantine ceramics.

Brides, neighbours and potteries: Ceramic distribution networks in the opper east of Ghana

Manuel Calvo[1)], Jaume García Rosselló[1)], Daniel Albero[1)], David Javaloyas[1)]

[1)] University of the Balearic Islands, Palma de Mallorca, Spain;

The pottery distribution studies have been usually focused on economical value of the products, means of transport, labour organization, technological and typological characteristics of the pots. This paper attempts, from an ethnoarchaeological point of view, to emphasize other variables such as the social relationships and ideological aspects in the creation of complex pottery exchange networks. These phenomena are essential to achieve a deepen understanding of how the communities produce and use the ceramics.

The case study we present here is centered in the Bunkpurugu-Yunyoo and Garu-Tempane districts in north-east Ghana where different ethnic groups, Mamprusi, Fulani, Komba, Kusasi, B'moba and Busanga, live together. In this region the aspects that affect the ceramics distribution and consumption patterns are multiple: infrastructures of mobility (roads, transport means), scale of production and qualities of the pots, labour organization, and territoriality or settlement systems. Nevertheless, social and familiar relationships, and also different social perceptions established between the various ethnic groups, are active agents that determine the distribution areas, networks and trade systems as well as the choices of pottery by consumers.

Our purpose is to suggest new approaches in the archaeological research of pottery which may expand the current views by providing new interpretative frameworks.

Ceramic industries of Mesoamerica's coastal wetlands

Hector Neff[1)], Satoru Murata[2)]

[1)] IIRMES, Long Beach, CA, USA;
[2)] Boston University, Boston, MA, USA;

The tropical coasts of Mesoamerica are lined with mangrove forests and estuaries that, while rich in many food resources, are of little use for agricultural production. As a result, once Mesoamerican people became fully committed to agricultural subsistence, probably during the Middle Formative period (~800-400 BCE), human habitation shifted away from the coasts. The coastal margins continued to be utilized for hunting, fishing, and shellfish collecting, but increasingly over time as well for industrial production. Salt extraction is one well-documented activity, and several lines of evidence are now indicating that large-scale ceramic production was another such activity. Moreover, excavation data from the Caribbean coast of Belize and survey data from southern Chiapas, Mexico indicate that the two activities were often carried out side-by-side, perhaps by the same workers. The intimate connection between the two industries appears to have stimulated technological innovation, perhaps including the invention of an alkaline glaze by Plumbate potters of southern Chiapas.

Identification of large-scale ceramic production facilities within the coastal wetlands may partially answer a question that has long puzzled Mesoamericanists, namely, why, given the super-abundance of archaeological pottery in post-Archaic Mesoamerican deposits, do surveys and excavations almost never encounter convincing evidence of ceramic production? At least for settlements proximate to coastal wetlands, the answer may be that ceramics were not produced near habitations but instead at special-purpose locations dedicated to industrial production that have rarely been the focus of archaeological investigation.

Pottery sourcing via petrography, portable XRF, and LA-ICP-MS: A study of production and circulation of the first pottery in Panama produced by farmers (ca. 4500-3200 B.P.)

Fumie Iizuka[1)], Hector Neff[2)], Richard Cooke[3)]

[1)] The University of Arizona, Tucson, AZ, USA;
[2)] California State University Long Beach, Long Beach, CA, USA;
[3)] Smithsonian Tropical Research Insitute, Panama, Panama;

Farmers who also hunted and fished began producing Monagrillo ware in central Panama around 4,500 years ago. This ware is found on the Pacific coast, at Pacific plains and foothills, and on the Caribbean slopes. The reconstruction of the degrees of residential mobility of the pottery producing people has been difficult. Our objective is to comprehend the patterns of pottery circulation, via sourcing, in order to reconstruct the degree of residential mobility associated with the economy. In EMAC 2009, we presented a study including the Monagrillo ceramic sourcing based on petrography. We inferred that ceramics can be classified into two types. One from the Azuero Peninsula, on the Pacific side, with granite based clay and others with paste based on mixed igneous rocks. The intra-site variability was lower than the inter-site variability indicating that many ceramics were produced in situ. However, classification of pottery with paste clays based on mixed igneous rocks was difficult. Thus, a chemical analysis was necessary. For EMAC 2011, we present our results from petrography, with increased sample size, and bulk compositional analysis using portable x-ray fluorescence and clay chemistry, using the laser ablation inductively coupled plasma mass spectrometry, of pottery and raw clays gathered in central Panama. As before, the intra-site variability was lower than the inter-site variability at most sites. More ceramics seem to have been transported from the Pacific foothills and the Caribbean slopes to the coast than vice versa. A site in the Pacific plains had nearly half of the ceramics coming form the Pacific foothills. This result on circulation allows a new interpretation on the residential mobility and exchange.

Advanced Hispanic Terra Sigillata and Late Hispanic Terra Sigillata from two different workshops in Burgos (Spain)

Jaume Buxeda i Garrigós[1)], Marisol Madrid i Fernandez[1)], F. Pérez Rodríguez-Aragón[2)], Jaime Nuño González[2)], Alonso Domínguez Bolaños[2)]

[1)] Universitat de Barcelona, Barcelona, Spain;
[2)] Mueso de Valladolid, Valladolid, Spain;

The Hispanic Terra Sigillata (HTS) production is the Terra Sigillata or Samian Ware produced in the Iberian Peninsula from the second half of the 1st to the 5th centuries AD. Advanced Hispanic Terra Sigillata (AHTS) (second half of the 2nd century – 3rd century AD) and, subsequently, Late Hispanic Terra Sigillata (LHTS) (4th-5th centuries AD) are the latter productions imply an important change of its technological properties, but also a change and reduction of the shapes produced.

From the archaeometric point of view, much more work has been devoted to the production centres of the HTS, while almost no attention has been paid, to present, to production centres of AHTS and LHTS. The present paper deals with two of these workshops, on the one hand El Cantarillón (Mambrillas de Lara, Burgos), and on the other hand La Colegiata (Covarrubias, Burgos). Both workshops are located in close vicinity in the province of Burgos, in northern central Spain, where these types of pottery have had their main diffusion.

The main purpose of this study is to define the reference groups of these two production centers and to investigate its diffusion in the Roman town of Clunia. 80 individuals from both workshops have been characterized by means of X-Ray Fluorescence (XRF) and X-Ray Diffraction (XRD) analyses in order to establish the reference groups and their technology. Furthermore, some selected individuals have been further analyzed by means of Scanning Electron Microscopy (SEM) in order to get more information on their technological aspects. The results have enabled to establish the reference groups and to perform a preliminary assessment of their diffusion in the area.

Transport Jars in the 16th century in the Caribbean

Samantha Ferrer[1)], Javier G. Iñañez[1)], Jaume Buxeda i Garrigós[1)], K. Deagan[2)]

[1)] Universitat de Barcelona, Barcelona, Spain;
[2)] University of Florida, Gainsville, USA;

The 16th century represents the starting point for the conquest of a new continent. The first years of the century account for an unprecedented clash and mixture of cultures, the European Renaissance and the different Native American societies. The potters from Sevilla, the main door to the Americas, were thus the main producers of transport jars for the New World.

The present paper preliminary explores the transport jars present in the Caribbean during this first century of European colonization. Therefore, transport jars from Sevilla itself have been characterized in order to asses the different reference groups that may exist in the town. Then, individuals from several sites in the Caribbean have also been characterized. This sites include La Vega Vieja (República Dominicana), a site founded by Columbus in 1494, Santa María la Antigua del Darién (Colombia), founded in 1510 as the first site with the title of Town in continental America, and Saint Agustine (Florida, USA), founded in 1565 as one of the first strategic military points in northern Caribbean. All individuals were analyzed by means of X Ray Fluorescence (XRF) for the studies of provenance, and X Ray Diffraction (XRD) for the studies on the technology used for their production. A selection of them has further been analyzed under the Scanning Electron Microscopy (SEM) in order to complement the technological study.

The first results show the existence of different reference groups in Sevilla that seem to correspond to different periods. These results are further contrasted in the Caribbean evidence.

Roman Pottery finds from Ilok-Castle of the Dukes of Ilok site excavations (2001-2004)

Kristina Jelincic

Institute of Archaeology, Zagreb, Croatia;

Pottery experts are very often confronted with the pottery finds that do not come from a closed archeological context. This is also the case with the Roman pottery from the excavation in Ilok (2001-2004). It is located on the spot which has been intensely inhabited from prehistoric till modern times. As a consequence, Roman pits, graves and layers located in the area where a medieval castle was built, are seriously disturbed. However, even without a closed archaeological context, it was considered necessary to closely examine these fragmented finds in order to gather as much information as possible prior to study of larger amount of pottery found during excavations from 2005 to 2008. The aim was to see what pottery classes were present and to find out the quantity of pottery fabrics. A structural analysis was only macroscopic with the aim to define main fabric groups. The work on the pottery showed that all main wares are present. Many analogies can be found in Pannonia Inferior and Moesia Superior. Furthermore our knowledge of Roman pottery from this part of Pannonia Inferior is fulfilled with new data about early imports from the West and distribution of Pannonian pottery products in the 3rd and 4th century.

The decorated Padan terra sigillata from Adria (north-eastern Italy): Provenance and production technology

Lara Maritan[1)], Michele Secco[1)], Valentina Mantovani[2)]

[1)] Department of Geosciences, University of Padova, Padova, Italy;
[2)] Department of Archaeology, University of Padova, Padova, Italy;

The archaeological excavation at the Retratto site (Adria, north-eastern Italy) brought to light massive amounts of terra sigillata objects, the morphological features and decoration types of which can be referable to the Padan-type. A series of particularly interesting samples, represented by stamped bowls signed by L. Sarius Surus, Clemens and Tripho, Aco -type beakers and plain plates, were archaeometrically investigated to define the provenance and the production technology, and to verify the archaeological hypothesis of a possible local production. For this reason, samples were analysed following a multianalytical approach, consisting of a combination of microscopic, chemical and mineralogical analyses. Results indicate that the plain potsherds are different from the decorated ones, suggesting the use of slightly different clay materials. The chemical similarities between plain terra sigillata from Retratto and local production of Etrusco-Padan-type pottery from Adria, suggest that at least the plates were locally produced. As for production technology, most of the terra sigillata from Retratto was fired between 850°C and 950°C. Multivariate statistical comparisons with literature data on Padan-type terra sigillata with the same types of decorations and signs, found in the roman trading centre of Magdalensberg (Austria), indicate that the terra sigillata from Retratto is chemically distinguished, with the exception of an Aco -type beaker which is compositionally compatible with the same type of objects from the Austrian site.

Assessing wine-trade from Hispania Tarraconensis (NE Spain) to Gallia Narbonensis (S France) in the Augustan period. Archaeometrical analysis of Pascual 1 amphorae from the Cap del Vol and Els Ullastres shipwrecks (Girona, Spain)

Verónica Martínez Ferreras[1)], Claudio Capelli[2)], Roberto Cabella[2)], Yavier Nieto Prieto[3)]

[1)] Universitat de Barcelona, Barcelona, Spain;
[2)] Universita degli Studi di Genova, Genova, Italy;
[3)] Museo Nacional de Arqueología Subacuática (ARQUA), Cartagena, Spain;

Wine trade between north-western Mediterranean provinces during the Augustan period is evidenced by several shipwrecks found out along the coast. Among them are the Cap del Vol and Els Ullastres shipwrecks, which are supposed to trade wine in Pascual 1 amphorae from Hispania Tarraconensis to Gallia Narbonensis.

We will present the results of the archaeometric study of 40 Pascual 1 amphorae from both shipwrecks, aimed at identifying the workshops of origin within Tarraconensis. Provenance investigation was based on chemical analysis by XRF and thin section analysis. Besides, XRD and SEM-EDS analyses were also carried out in order to identify secondary mineral phases taking place during deposition in the maritime environment, which must be considered to establish valid chemical reference groups. The results have been compared with the large analytical database on amphorae productions from the Tarraconensis province available at the ERAAUB.

The archaeometric study revealed that Pascual 1 amphorae from both shipwrecks were produced in specific workshops placed on the central Catalan Coast, near the main Roman cities of Baetulo (Badalona) and Iluro (Mataró). This result points to the important role of these two cities in the economic expansion of Tarraconensis during the Augustan period.

KEYWORDS: Catalan shipwrecks, chemical, mineralogical and petrographical analysis, Pascual 1 amphorae, wine trade

Chemical and morphological analysis of ancient pottery discovered in the middle Euphrates valley

Maripaz Mateo[1)], J.L. Montero[1)], G. Nicolas[1)]

[1)] Universidad de A Coruña, Ferrol (A Coruña), Spain;

Since 2008, a multidisciplinary expedition has discovered pottery pieces from an excavations campaign in several Syrian enclaves in the Middle Euphrates valley, where the centre of the birth of civilization in Mesopotamia, dated to 5,500 years ago, is located. This city would be one of the oldest cities of the History, representing therefore the passage from the rural cycle to the urban cycle. The objective of the expedition was to determine what the concept of border was from the IV millennium to the Byzantine period. Among the artifacts uncovered, the collection of ceramics found would allow to study the origins of the civilization and the writing and to understand how life was in an epoch privy of information.

In this work, the morphology and composition of several fresh sections of pottery from Uruk culture and found in the Euphrates valley during the excavations campaign have been analyzed by scanning electron microscopy and energy-dispersive X-ray spectroscopy. The results will also show the presence of some structures different from ceramic matrix which were trapped during the process of pottery making.

Preliminary archaeometric results on the possible Phoenician productions of Tyre

Eva Miguel Gascón[1)], Jaume Buxeda i Garrigós[2)]

[1)] Centro de Ciencias Humanas y Sociales (CCHS), Madrid, Spain;
[2)] Universitat de Barcelona, Barcelona, Spain;

There are very few archaeometric studies conducted on the Iron Age sites of Lebanon. Indeed, there is a great imbalance in the information published on fabric analysis in the Levant. Most of the bibliography comes from sites located in Palestine and therefore in recent years the characterization of metropolitan Phoenician pastes is taking from proxy data. In an attempt to provide direct information about the characteristics of the Phoenician productions, one hundred individuals of pottery from the necropolis of Tyre - Al Bass have been sampled. All individuals have been analyzed by means of X-Ray Fluorescence (XRF) and X Ray Diffraction (XRD) analyses in order to shed light on chemical and mineralogical information to define references groups and the technology employed. Furthermore, some selected individuals, according to the previous results, have been further analyzed by means of Scanning Electron Microscopy (SEM) in order to shed light on microstructure and vitrification stage. Thus, the present study represents the first steps toward the characterization of the Phoenician ceramics of Tyre in order to describe the different fabrics and differentiate possible productions.

A multivarite technique to analyse stylic variations in the pottery assemblage

Kamal Aldin Niknami[1)], Sadjad Alibeigi[1)], Hannan Bahranipur[1)]

[1)] University of Tehran, Teheran, Iran;

The study of pottery assemblages may give valuable information in archaeology as both a cultural and chronological indicator. A study is described of an Iron Age burial site of Sarm, north central Iran , where 80 graves were excavated and a total of 1282 pots in combination with other grave materials have been registered during the 3 years of excavation from 2001 to 2003. Compared to other cemeteries in the area, Sarm stands out as the most important burial site between 900 -1500 BC, with an extremely large, rich and well-documented data material. The focus of this work is on two specific and interrelated aspects of grave goods particularly pottery and burial rites. The work has been performed in a systematic manner using a combination of simple descriptive statistics and more complex exploratory multivariate techniques particularly correspondence analysis. The techniques were used to identify type compositional characterization of grave goods (1) to identify types or groups that can be clearly differentiated from other groups to reveal a meaningful archaeological interpretation, (2) to investigate whether there were variations in the type from graves and whether a classification could be used as a basis for an explanation of ritual patterns. Through pattern recognition and statistical analyses, we need to consider possible correspondence between and among the analytical units and ultimately among the various grave types. During this process we would define some of the cultural parameters that shaped burial rites and identify and assess observable patterning that links the pottery styles, grave materials and ultimately burial rites. The results of these quantitative examinations were then investigated to determine if any new patterns could be noted in the data. In general, this study suggests a clear picture of the interrelationships in the data and has led to prove the method to address more theoretically oriented questions.

Ceramic production development guides to understand Khmer Stonewarecharacteristic, from late 9th to early 15th century, Cambodia

Chhay Rachna

APSARA, Siem reap, Cambodia;

During a last few year, many kiln sites in Angkor region excavated by the national and the international teams, such as Tani, Thnal Mrech, Sor sie, Khnar Po, and Bangkong kiln site. All these kilns used a crossdraft technique to produce glaze and unglaze stoneware. Methods used to develop these studies such as physical properties of pottery, evidence of pottery making, and Vessel shape. All production technique let researchers understand, how and when, Khmer Ceramic was developing in their own characteristic. The paper will focus on: the ceramic classification of each kiln site, the ideas of decorations and forming methods, standardization of the productions, and the distinction of those kilns productions, which show the evidence of specialized craft productions in Khmer Ceramic Technology.

Ceramic vessels from the workshop centre of Viminacium

Angelina Raickovic

Institute of Archaeology, Belgrade, Serbia;

The subject of topic is ceramic vessels from the workshop centre of Viminacium. This workshop is one of the biggest explored complexes for manufacturing pottery and bricks at the area of roman provinces Upper Moesie, Pannonia and Dacia.

It consists from 13 till now excavated kilns (ten for pottery and three for bricks). The products of these kilns are wide spread in Upper Moesia, just as in the surrounding roman provinces. More than 45000 pieces classified into 15 basic forms and in 130 types of vessels have been found.

The largest amount of forms belongs to a ceramic vessels used for serving food, than for preparation, cooking and baking food, while the luxurious pieces are represented with a very few examples. The most numerous variety of the forms are characterizing bowls and pots, while the least numerous are the pithoi and paterae. The main market for their merchandise was consisted of the local inhabitants and the soldiers of the Legion VII Claudia. When exported, the merchandise took the route defined by Danube-river. So the most finds are originated from the places along the river while in the inner of the provinces are quite rare.

Analyzed ceramic material is found in the closed entities of workshop centre of Viminacium, in the heating of the kilns, in the pits alongside the kilns. The chronological determination of this manufacture complex comprises the end of II and the whole III centrury.

Investigation of clay sources for production of olivine-tempered ceramics in the Arizona strip and adjacent areas in the American Southwest

Sachiko Sakai

University of California Santa Barbara, Irvine CA, USA;

The American Southwest has been focused for the study of ceramic production and distribution for decades. The ceramic assemblage in the Arizona Strip and adjacent areas in Utah and Nevada is characterized by widely-distributed ceramics tempered with olivine, a volcanic mineral, between A.D. 100 and 1300. The source of this olivine is thought to be at Mt. Trumbull and Tuweep, near the northwest rim of the Grand Canyon. Olivine-tempered ceramics are distributed westward from these olivine source areas over a range of more than 100 km. The ultimate goal for this study is to understand the evolution of production and distribution patterns of olivine-tempered ceramics among agricultural groups in the unstable environment of northern Arizona and southern Nevada. To investigate the source of olivine-tempered ceramics, Laser-ablation ICP-MS (LA-ICP-MS), was used. The previous study on 311 ceramics with 104 clays from Mt. Trumbull and the lowland Virgin area shows at least six compositional groups in clay matrix of olivine tempered ceramics. This study suggested the selection of clays may have been practiced for different purposes in the Mt. Trumbull area. This study also hypothesized that some of the olivine tempered ceramics were produced in the lowland Virgin area, while others are imported from Mt. Trumbull. Testing these hypotheses requires a larger sample size of ceramic matrix data which will facilitate an investigation of the source of the olivine-tempered ceramics using more powerful statistic tools. In this paper, I will present the result of compositional analysis to find the better approach to understand the lager data base (N=1267) to test these hypotheses.

Reading the images: reconstructing ancient networks in South Asia and beyond.

Jo Shoebridge

Durham University, Durham, United Kingdom;

This research project aims to investigate the South Asian ceramic Arikamedu Type 10 through the study of its stylistic attributes and their spatial and chronological variants. This ceramic displays highly diagnostic features which will support the reconstruction of Early Historic South Asian communication networks. Arikamedu Type 10 was first formally identified at Arikamedu in 1945 (Wheeler et al : 1946) and recorded in India, Sri Lanka, Egypt, and Indonesia to date.

This project has piloted an image analysis technique for stylistic study as previous scientific provenancing methods, for example thin section analysis (Krishnan and Coningham 1997) and ICP–AES (Ford et al 2005), failed due to the geological consistency of Peninsula India and Sri Lanka.

Using data primarily from Arikamedu and Anuradhapura, this poster will demonstrate the viability of the approach in the reconstruction of Indian Ocean trade.

Ford, L. Pollard, A. M., Coningham, R. A. E., and Stern, B. 2005. A geochemical investigation of the origin of Rouletted and other related South Asian fine wares. Antiquity 79:909–920.

Krishnan, K. and Coningham, R. A. E. 1997. Microstructural analysis of samples of Rouletted ware and associated pottery from Anuradhapura. In B. Allchin & F. R. Allchin (eds.) South Asian archaeology,1995: proceedings of the 13th conference of the European Association of South Asian Archaeologists, Cambridge, 5-9 July 1995 . 925-937 Delhi: Oxford & IBH.

Wheeler, M., Ghosh, A. and Deva, K. 1946. Arikamedu: An Indo-Roman trading-station on the east coast of India. Ancient India 2:17–124.

Island Records: Technological Analyses of the "Chalices" from Marco Gonzalez, Belize

Carmen Ting[1)], Linda Howie[2)], Elizabeth Graham[1)]

[1)] Institute of Archaeology, University College London, London, United Kingdom;
[2)] Department of Anthropology, University of Western Ontario, Ontario, Canada;

This paper describes the results of a technological study of the 'chalices', from the site of Marco Gonzalez, Belize. These vessels, which can be described as pedestal-based, composite silhouette dishes with distinctive orange-red slip, are a diagnostic element of a distinctive style of service ware that was produced in the Eastern Maya Lowlands during the Early Postclassic (AD950-1150/1200). This period cultural development is often characterized as 'dark age' of Maya civilization, directly following the Maya Collapse. Chalices were first reported at the inland city center of Lamanai and subsequently have been recorded at approximately a dozen sites across Belize, including the port and trading community of Marco Gonzalez on Ambergris Caye. Local production of chalices at Lamanai has been demonstrated through petrographic and chemical analyses, but the origin(s) of manufacture of the chalices that occur at other sites has yet to be determined. The large and visually varied assemblage of chalices from Marco Gonzalez permits detailed examination of technological and provenance variability, through an integrated study that combines visual examination, thin-section petrography, ED-XRF, and SEM-EDS. The new information brought to light through this study contributes significantly to current understanding of networks of exchange and socio-economic interaction during the Early Postclassic, as well as the kinds of factors that enabled this island community to thrive.

These results indicate the high degree of skilled and knowledgeable practice being undertaken during this period and provide a good insight into the level of interaction between sites and potting communities.

New archaeometric data on Late Antique common wares in the bay of Naples. Characterization of provenance and technology

Luana Toniolo[1)], Eliana Andaloro[2)], Anna Maria De Francesco[2)]

[1)] Università Ca' Foscari di Venezia, Venezia, Italy;
[2)] Università della Calabria, Cosenza, Italy;

In this study we present the results of archaeometric investigations carried out on several samples of common wares from Naples using optical microscopy, XRD and XRF.

The study of some ceramic assemblages dating to the late 4th century AD-beginning of the 5th century AD from urban excavations in Naples highlighted a complex regional landscape of production and exchange as regards cooking wares and common wares. The cooking wares are mainly imitations of contemporary African prototypes while the common wares seem to belong to the previous ceramic tradition. The present study aims to investigate the regional mechanisms of pottery distribution through the characterization of provenance of the different wares recovered in the excavations. Futhermore, the study of some technological properties such as the firing temperature and the vitrification patterns permits to analyze the changing in the ceramic technology during an age of transition from the roman tradition to the new horizons of the early medieval age.

The analytical approach combined minero-petrographic analysis and chemical analysis (XRF) and focused with particular attention on the possible "local" productions, as to assess the potential role of Naples as an important potting centre in the region. The compositional heterogeneity of the local productions clearly shows that more than one workshop was involved in the production of these wares.

Chemical characterization and same production studies on transparent Turquouse Blue glazed of Tiles from Kubad Abad Palace

Serife Yalçin Yasti[1)], Nuran Ay[2)]

[1)] Selçuk University, Konya, Turkey;
[2)] Anadolu University, Eskisehir, Turkey;

Chemical characterization was performed on glazed tile fragment obtained from the Kubad Abad Palace excavation area which was built during Seljuk Empire Beyşehir-Konya. Kubad Abad Palace's tiles are one unique for figures and lusters in their era. The selected tile samples with underglaze black decorated t ansparent turquouse blue glazes were characterized using scanning electron microscopy coupled with an energy dispersive X-ray spectroscopy system (SEM-EDX) and stereo microscopy techniques. With recpect to the obtained datas reproduction glazes were prepared. These reproduction glazes were characterization with an energy dispersive X-ray spectroscopy system (SEM-EDX) and stereo microscopy techniques. Results were compared and discussed.

List of participants (according to registration information)

Alexiou, Konstantinos	21st Ephorate of Prehistoric and Classical Antiquities, Athens	alexiouk75@gmail.com
Almeida, Shari	Universidade Nova de Lisboa, Caparica	sharibel@gmail.com
Alonso Lopez, Elisa	University of Leicester, School of Archaeology and Ancient History, Leicester	eal9@le.ac.uk
Andaloro, Eliana	Università della Calabria, Rende	eliana.andaloro@unical.it
Bajnóczi, Bernadett	Institute for Geochemical Research, HAS, Budapest	bajnoczi@geochem.hu
Baranowski, Marcin	University of Warsaw, Warsaw	bmjj@o2.pl
Biró T., Katalin	Hungarian National Museum, Budapest	tbk@ace.hu
Borgers, Barbara	Free University of Brussels, Brussels	bborgers@vub.ac.be
Braekmans, Dennis	K.U.Leuven, Section Geology - Earth and Environmental Sciences, Heverlee	dennis.braekmans@ees.kuleuven.be
Budak Ünaler, Meral	Izmir Yüksek Teknoloji Enstitüsü, Izmir	meralbudak@gmail.com
Burke, Clare	University of Sheffield, Department of Archaeology, Sheffield	prp08ctb@sheffield.ac.uk
Buxeda i Garrigós, Jaume	Universitat de Barcelona, Barcelona	jbuxeda@ub.edu
Calvo, Manuel	University of the Balearic Islands, Palma de Mallorca	daniel_albero@hotmail.com
Carvajal, Jose C.	The University of Sheffield, Department of Archaeology, Sheffield	j.carvajallopez@sheffield.ac.uk
Coentro, Susana	Universidade Nova de Lisboa, Caparica	scoentro@fct.unl.pt
Dasari, Kishore Babu	GITAM University, Visakhapatnam	dkishore4u@gmail.com
Daszkiewicz, Malgorzata	ARCHEA, Warszawa	schnarch@zedat.fu-berlin.de
Day, Peter M.	University of Sheffield, Department of Archaeology, Sheffield	p.m.day@sheffield.ac.uk
Di Febo, Roberta	Universitat de Barcelona, Dept. de Prehistòria, Barcelona	jbuxeda@ub.edu
Dimoula, Anastasia	Aristotle University of Thessaloniki, Thessaloniki	adimoula@hist.auth.gr
Emami, Mohammadamin	Art University Siegen, Faculty of Conservation, Isfahan	emami@chemie.uni-siegen.de
Emery, Laetitia	IRAMAT CRP2A, Pessac	laetitia.emery@gmail.com
Epossi Ntah, Zoila Luz	Universität Leipzig, IMKM, Leipzig	epossi@uni-leipzig.de
Eramo, Giacomo	Università degli Studi di Bari "A. Moro", Bari	giacomo.eramo@geomin.uniba.it
Fabbri, Bruno	CNR-Istituto di Scienza e Tecnologia dei Materiali Ceramici, Faenza	bruno.fabbri@istec.cnr.it
Ferrer, Samantha	Universitat de Barcelona, Barcelona	jbuxeda@ub.edu
Fragnoli, Pamela	Modena e Ferrara, Modena	pamela.fragnoli@unife.it
Fraser, James	The University of Sydney, Sydney	jfra4013@uni.sydney.edu.au
Gabriele, Marzia	Università di Pisa, Pisa	martacolo@libero.it
Geba, Maria	Moldova National Complex of Museums, Iasi	mariageba49@gmail.com
Georgopoulou, Viktoria	freelance, Alimos	hein@ims.demokritos.gr
Ghalijaei, Mohammad	Research center, Isfahan	mari_soltany@yahoo.com
Gheorghiu, Dragos	National University of Arts, Bucharest	gheorghiu_dragos@yahoo.com
Ghoraeian, Sedigheh	University of Tehran, Teheran	s_ghoraeian@yahoo.com
Gligor, Mihai	1 Decembrie 1918 University, Alba Iulia	mihai.gligor@uab.ro
Golubovic, Snezana	Archaeological Institute, Belgrade	arheosneska@gmail.com
Graybehl, Heather	University of Sheffield, Department of Archaeology, Sheffield	hlgraybehl1@sheffield.ac.uk
Gregor, Milos	Geological Institute, Comenius University, Bratislava	geolgregor@yahoo.com
Harsányi, Eszter	Archäologisches Landesmuseum Baden-Württemberg, Rastatt	gyorgy.szakmany@geology.elte.hu
Hein, Anno	N.C.S.R. "Demokritos", Aghia Paraskevi	hein@ims.demokritos.gr
Hein, Irmgard	University of Vienna, Vienna; Uppsala Universitet, Uppsala	irmgard.hein@univie.ac.at
Hoeck, Volker	Paris Lodron University, Salzburg	volker.hoeck@sbg.ac.at
Hunt, Alice	UCL Institute of Archaeology, London	alice.hunt@ucl.ac.uk
Iizuka, Fumie	The University of Arizona, Tucson, AZ	fiizuka@email.arizona.edu
Iñañez, Javier G.	Universitat de Barcelona, Dept. de Prehistòria, Barcelona	javiergarcia@ub.edu
Ionescu, Corina	Babes-Bolyai University, Cluj-Napoca	cora22x@yahoo.com
Izabella, Havancsák	HAS-Geochemical Research Institute, Budapest	havancsaki@gmail.com
Jelincic, Kristina	Institute of Archaeology, Zagreb	kristina.jelincic@iarh.hr
Karatasios, Ioannis	N.C.S.R. "Demokritos", Athens	ikarat@ims.demokritos.gr
Kern, Angelika	University of Vienna, Vienna	a0101905@unet.univie.ac.at
Kibaroglu, Mustafa	University of Frankfurt, Tübingen	kibaroglu@gmail.com
Kilikoglou, Vassilis	N.C.S.R. "Demokritos", Athens	kilikog@ims.demokritos.gr
Kilinc Mirdali, Nergis	Çukurova University, Department of Ceramic, Adana	nkilinc@cu.edu.tr
Kowarik, Kerstin	Natural History Museum, Vienna	kerstin.kowarik@nhm-wien.ac.at
Labbaf-Khaniki, Meysam	University of Tehran, Teheran	meysamlabbaf@yahoo.com
Le Miere, Marie	Archéorient - CNRS, Lyon	marie.le-miere@mom.fr
Leclerc, Mathieu	Australian National University, Canberra	mathieu.leclerc@anu.edu.au
Li, Weidong	Shanghai Institute of Ceramics, Shanghai	liwd@mail.sic.ac.cn
López García, Pedro	Escuela Nacional de Antropología e Historia, México	
López-Grande, María José	Universidad Autónoma de Madrid (Spain), Tres Cantos	mariajose.lopez@uam.es
Luo, Hongjie	Shanghai Institute of Ceramics, Shanghai	turina2006@hotmail.com
Madrid i Fernandez, Marisol	Universitat de Barcelona, Barcelona	
Maggetti, Marino	Fribourg, Fribourg	marino.maggetti@unifr.ch
Maritan, Lara	Department of Geosciences, University of Padova, Padova	lara.maritan@unipd.it
Martínez Ferreras, Verónica	Universitat de Barcelona, Barcelona	vmartinez@ub.edu
Mateo, Maripaz	A Coruña, Lab. Aplicaciones Industriales del Láser, Ferrol	pazmateo@udc.es
May, Zoltán	HAS Chemical Research Center, IMEC, Budapest	mzozo@chemres.hu
Miguel Gascón, Eva	Centro de Ciencias Humanas y Sociales (CCHS), Madrid	jbuxeda@ub.edu
Molera, J.	Universitat de Vic. C. de la Laura, Vic	trinitat.pradell@upc.edu
Monette, Yves	Canadian Museum of Civilization, Gatineau	yves.monette@civilisations.ca
Moradi, Hossein	ICHTO, Borujen	h_moradi57@yahoo.com
Müller, Noémi Suzanne	University of Barcelona, Barcelona	noemi.s.mueller@gmail.com
Muntoni, Italo Maria	Soprintendenza per i Beni Archeologici della Puglia, Foggia	italomaria.muntoni@beniculturali.it
Neff, Hector	IIRMES, Department of Anthropology, Long Beach	hneff@csulb.edu
Nilhamn, Bonnie	Vrije universiteit, Amsterdam, Tiel	bnilhamn@gmail.com

Pánczél-Bajnok, Katalin	Eötvös Loránd University, Institute of Archaeological Sciences, Budapest	kata@bajnok.hu
Peloschek, Lisa	University College London; University of Vienna, Bad Erlach	lisa.peloschek@gmail.com
Pentedeka, Areti	Fitch Laboratory, British School at Athens, Athens	flpetrology@bsa.ac.uk
Pérez-Arantegui, Josefina	University of Zaragoza, Zaragoza	jparante@unizar.es
Powis, Terry	Kennesaw State University, Kennesaw	tpowis@kennesaw.edu
Pradell, Trinitat	Universitat Politècnica de Catalunya, Barcelona	trinitat.pradell@upc.edu
Quercia, Alessandro	School of Archaeology and Ancient History, Leicester	aq15@le.ac.uk
Quinn, Patrick	University College London, Institute of Archaeology, London	patrick.quinn@ucl.ac.uk
Rachna, Chhay	APSARA, Siem reap	chhayrachna2010@gmail.com
Raickovic, Angelina	Institute of Archaeology, Belgrade	araickovic@yahoo.com
Rondiri, Vasso	13th Ephorate of Prehistoric and Classical Antiquities, Volos	rondiriv@yahoo.gr
Rosado, Lúcia	University of Évora, HERCULES Laboratory and Chemistry, Évora	lclrosado@hotmail.com
Sakai, Sachiko	University of California Santa Barbara, Irvine	sachikosak@gmail.com
Sarjeant, Carmen	The Australian National University, School of Archaeology & Anthropology, Canberra	Carmen.Sarjeant@anu.edu.au
Scarpelli, Roberta	Università della Calabria, Dipartimento di Scienze della Terra, Cosenza	roberta.scarpelli@unical.it
Shoebridge, Jo	Durham University, Department of Archaeology, Durham	j.e.shoebridge@durham.ac.uk
Shun Kai Willy, Bong	Tokyo University of Science, Tokyo	jb109710@ed.kagu.tus.ac.jp
Silva, Teresa	LNEG-Unity of Mineral Resources and Geophysics, Amadora	teresa.pena@lneg.pt
Soltani, Maryam	Islamic Azad University, Isfahan	mari_soltany@yahoo.com
Soltanzadeh, Shadi	Tehran Islamic Azad university, Isfahan	soltanzadeh.sh@gmail.com
Strack, Sara	University of Leicester, Leicester	ss614@le.ac.uk
Szilagyi, Veronika	Hungarian Academy of Sciences, Institute of Isotopes, Budapest	szilagyi.vera@gmail.com
Taché, Karine	University of York, Montréal	karine.tache@umontreal.ca
Tenconi, Marta	Università degli studi di Padova, Facoltà di Archeologia, Padova	marta.tenconi@gmail.com
Ting, Carmen	Insitute of Archaeology, University College London, London	carmen.k.ting@gmail.com
Toniolo, Luana	Università Ca' Foscari di Venezia, Sant Elena	luana.toniolo@libero.it
Tsantini, Evanthia	Università degli studi di Palermo, Palermo	evatsantini@yahoo.es
Tschegg, Cornelius	University of Vienna, Department of Lithospheric Research, Vienna	cornelius.tschegg@univie.ac.at
Waksman, Yona	Laboratoire de Céramologie, Lyon	waksman@mom.fr
Yalçin Yasti, Serife	Selçuk University, Konya	syasti@selcuk.edu.tr